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OTOSCLEROSIS IN ITS HISTOGENIC RELATIONS TO OSTEODYSTROPHIA FIBROSA (OSTITIS FIBROSA) ¹

MORITZ WEBER, M D

SAN FRANCISCO

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The relations between otosclerosis and osteodystrophia fibrosa have received considerable attention in the literature from both the clinical and anatomic standpoints. However, to my knowledge no special critical comparison of these two diseases from the standpoint of histogenesis has appeared considering the most recent contributions made to the pathology of osteodystrophia fibrosa. Therefore a study in this direction seems advisable.

O Mayer said, in 1928 "Another disease of bone, however—the osteitis deformans of Paget—has a connection with otosclerosis. Even

* Submitted for publication, Aug 13, 1929

* From the George Williams Hooper Foundation for Medical Research, University of California

This study was aided by grants from the John C and Edward Coleman Memorial Fund

during my earliest investigations of otosclerosis I was struck with the similarity of this condition to that found in osteitis deformans." He stated further that the original bone in both diseases is replaced by newly formed bone, and that this process may lead to an ankylosis of the stapes. "The difference, however, consists in the fact that in Paget's disease the lesion is not restricted to localized areas, but is diffuse, and further, that the new-formed bone is better developed, still, I have been impressed by the fact that in some instances of Paget's disease there were localized lesions similar to those found in otosclerosis." He continued that in the cases observed by him in which both diseases were present it may be attributed to coincidence, but he thought it more likely that there are certain genetic relations.

A review of the literature reveals that no positive agreement has been reached concerning the question of a relation between otosclerosis and the so-called *ostitis fibrosa*.¹ On the contrary, a negative result has been obtained: otosclerosis is not identical with generalized *osteodystrophia fibrosa*.

All previous research to solve this problem has been made by otologists. For this reason, otosclerosis has been in the limelight of discussion. These investigations were rendered more difficult by the fact that the nature of Paget's disease was not yet definitely determined. In the last decade, however, a more definite understanding of the nature of *osteodystrophia fibrosa* has been reached through the classic works mentioned in the bibliography. Above all, it has definitely been established by the work of Frangenheim, Kaufmann, Koch, Pick, Schmoil, Willich et al. that there exists a localized form of *osteodystrophia fibrosa*. Hence the problem under discussion has developed a new aspect: one can balance otosclerosis—as a focal disease—against a localized *osteodystrophia fibrosa*. The present problem culminates in the question: Does there exist any histologic relation in development between an otosclerotic focus and that of a localized *osteodystrophia fibrosa*?

From the abundant literature of *osteodystrophia fibrosa* it is known that the localized form presents the same histologic appearance as a partial picture of a generalized form. The condition may be compared with tuberculosis: one tubercle of a generalized miliaary dissemination from a purely histologic standpoint, gives exactly the same picture as a tubercle of a strictly localized form.

In regard to the histogenesis of a limited diseased area—as represented in the bone changes in otosclerosis—the aforestated question may be expanded: one may substitute the term "partial picture of a

¹ The author prefers the modern term "*osteodystrophia fibrosa*" and follows the classification of Christeller (1926).

generalized form" for "local osteodystrophia fibrosa." Thus the question of distribution (local or general) is eliminated, and the histogenesis of osteodystrophia fibrosa in general may be balanced against that of otosclerosis. However, by no means is this to be taken as a statement that otosclerosis is identical with generalized osteodystrophia fibrosa.

My own studies of osteodystrophia fibrosa began in 1926 with observations made on ground sections of bone in a case of Pager's disease from the collection of Prof. L. Pick of Berlin. The use of the polarized light proved of great value in this connection. Certain diagnostic features of osteodystrophia fibrosa were described which are of importance in the differential diagnosis of doubtful syphilitic lesions in prehistoric bones.

In order to establish a foundation for further studies of bone pathology—especially osteodystrophia fibrosa and otosclerosis—a paper was published in 1928 entitled "Bone Pathology and Its Relation to the Problem of Otosclerosis." The fundamental aspects of normal bone development were presented from a new point of view with their significance for bone pathology in general, and otosclerosis, in particular. This led to the conclusion that otosclerosis is primarily a problem of bone pathology rather than of otology.

In a recent paper appearing in German (*Beitr. z. allg. Path. u. path. Anat.* 82:383, 1929) I have attempted to present the nature of osteodystrophia fibrosa. These investigations were based aside from the literature and my earlier observations, on observations in a Boston terrier with osteodystrophia fibrosa. The organ of hearing of this animal, however, was not discussed in detail, but was reserved for the present paper, since its significance for the problem of otosclerosis was apparent. Therefore, the following study should be regarded as supplementary to the German paper.

In contradistinction to earlier authors who have studied the problem, I approached the question of otosclerosis from studies made on osteodystrophia fibrosa. Hence osteodystrophia fibrosa will be kept in the limelight.

OBSERVATIONS IN A CASE OF OSTEODYSTROPHIA FIBROSA IN A DOG

SUMMARY OF GENERAL OBSERVATIONS PUBLISHED IN A PREVIOUS PAPER

Before entering into a more detailed discussion of the labyrinthine capsule of the Boston terrier with osteodystrophia fibrosa I shall give a cursory review of the general observations as presented in my German paper (1929).

One is dealing with a juvenile hyperostoticporotic form of osteodystrophia fibrosa forming pseudotumors and cysts (so-called *ostitis fibrosa von Recklinghausen*) in a female Boston terrier of 8½ months²) A study of the literature reveals that this form is rare in dogs It may be of interest to note from the clinical history, that the owner raised the animal exclusively on Spiatt's "Fibo" and tea

This bone disease resembled the snuffles of pigs, referable to osteodystrophia fibrosa (Rehn, Ingier) The upper jaw was distended by a tumorous growth This was diagnosed as an intra-osseous epulis (Nelaton) originating from the endosteum of the alveolar bone Many cysts were observed in this new formation, which must be regarded as a 'brown tumor' (pseudotumor) The epulis appeared in the course of a generalized osteodystrophia fibrosa and thus not only presented the morphologic picture of an osteodystrophia fibrosa but also bore a genetic relation to this disease

As for the internal organs, the thyroid showed changes as observed in hypothyroidism, whereas the parathyroids were morphologically normal

Differential diagnosis excluded rickets, osteomalacia and the generalized osteoporoses However, a slight scorbutic tendency may have been present A progressive atrophy of the bone was observed in a limited area, which bore a close resemblance to the dissecting atrophy of Pick This might well represent an early stage of osteodystrophia fibrosa

DETAILS OF THE CONDITION IN THE ORGAN OF HEARING

The temporal bones were partially decalcified according to the method of Pommer (Muller's fluid with a small amount of nitric acid) Horizontal serial sections were made after the bones were embedded in a collodion preparation Some of the sections were stained with Delafield's hematoxylin and eosin and others with thionin picric acid (Schmorl)

In general, the same changes could be observed in both the right and the left organs of hearing Thus they may be treated jointly

Desquamated epithelium was found in the external meatus, on both sides The tympanic membranes were normal Likewise, the ossicles showed no pathologic changes There was no ankylosis of the stapes nor any calcification of the ligamentum circulare On the right, a coagulated serous fluid, containing no leukocytes, lay around the stapes and in the niche of the round window The mucous membrane of the middle ear was not thickened The membranous labyrinth showed postmortem

2 This case was kindly submitted for examination by Dr H Searls, veterinary surgeon and Dr Philip K Brown, Chief of the Medical Department of the Southern Pacific General Hospital, San Francisco

changes and artefacts which obviously originated from the cutting of an incompletely decalcified specimen

The bony system of the more distant surroundings of the labyrinth revealed essentially the same changes as were observed in the long bones. The tendinous insertions showed resorption by giant cells, as well as fibrous marrow with hyaline islands (fig 1). However, one found such foci originating not only from the outside, i. e., the periosteum, but also from the inside, i. e., the endosteum (fig 2). The bone bounding the labyrinthine capsule contained marrow consisting



Fig 1—Osteodystrophia fibrosa beneath the periosteum and at the tendinous insertions, embedded in a collodion preparation (spec 545/12), stained with hematoxylin and eosin, seen with Leitz objective 16 mm, eyepiece 6 X, magnified 70 1

principally of lymphoid and fat tissue. However, where the marrow lay next to the fibrocartilaginous partitions, it became fibrous with resorbing giant cells. The mastoid process was only slightly pneumatized. In general, the spaces of the spongy bone were filled with normal bone-marrow. One portion of the spongy bone presented the picture of dissecting atrophy (fig 3). This was also observed in the substantia spongiosa of a vertebra.

The bone surrounding the labyrinthine capsule showed as did the other bones of the skeleton a typical osteodystrophia fibrosa.



Fig 2—Osteodystrophia fibrosa arising from the endosteum, an illustration of the so-called "granulation tissue", embedded in a collodion preparation (spec 545/13) hematoxylin-eosin stained, seen with Leitz objective 16 mm, eyepiece 6 X, magnified 140 1



Fig 3—Dissecting atrophy within the spongy bone of the mastoid process, resorption by giant cells, fibrous marrow, embedded in a collodion preparation (spec 545/29) hematoxylin-eosin stained, seen with Leitz objective -6 mm, eyepiece pro: II, magnified 200 1

In regard to the problem of otosclerosis special interest is to be concentrated on the changes in the labyrinthine capsule proper. A low magnification revealed a rarefaction of the capsule (fig 4). There were more or less irregular cavities large and small the relation of the origin of which to the vascular system was evident. Within the cavities were giant cells which resorbed the bone, enlarging the spaces. Besides giant cells and hyperemic vessels the cavities contained a young embryonic connective tissue or a more fibrous marrow typical of



Fig 4—Generalized hypo-ostoticporotic form of osteodystrophia fibrosa in the labyrinthine capsule: resorption cavities, giant cells, mesenchymal tissue, fibrous marrow, osteoid tissue deposited in lacunae, embedded in a collodion preparation (spec 545/15) hematoxylin-eosin stained, seen with Leitz objective 3 mm, eyepiece 6 X, magnified 75 X.

osteodystrophia fibrosa. The walls of the cavities were sharply limited and showed lacunae toward the lumen. In several places a small osteoid margin bounded the wall. This osteoid portion for the most part was separated from the true bone by a visible line of cementum, and must therefore be regarded as a new formation (uncalcified bone).

The processes taking place in the cartilaginous remnants within the labyrinthine capsule require a more detailed consideration. A par-

ticularly large cartilaginous remnant was situated on the right as well as on the left, beneath the horizontal semicircular canal. The cartilage wound from below around the inner limb of the horizontal canal, ending at the plane of the diameters. The most interesting changes took place at this termination (fig 5). About in the center of the semicircle there were several cystic spaces, surrounded by hemorrhages and an infiltration of round cells. Toward the loop of the semicircular canal, there was connective tissue containing few nuclei and much hyaline inter-



Fig 5—Osteodystrophia fibrosa around a cartilaginous remnant within the petrous bone, calcification of the intercellular substance of the cartilage leading to a "cartilaginous nucleus," embedded in a collodion preparation (spec 560/13), hematoxylin-eosin stained, seen with Lertz objective 16 mm, eyepiece 6 X, magnified 140 1

cellular substance. This hyaline connective tissue abutted on the cartilaginous remnant. The cartilage cells were vesicularly distended. The intercellular substance was calcified and stained deep blue with hematoxylin. Toward the connective tissue, it became granular crumbly, and gradually ended. Next to the cartilaginous focus in fig 5 may be seen a large resorption cavity lined with osteoid substance, which had been deposited in lacunae. Within the osteoid substance lay

large dark cells, of which the nuclei only were visible. The osteoid portion was lined with osteoblasts toward the lumen. Its cavity was filled with vessels, loose young connective tissue and fibrous marrow. Thus, preliminary resorption had ceased and the formation of new bone had been instituted.

The same changes were repeated in other cartilaginous remnants. Everywhere the cartilage was calcified to a great extent and in a process of transformation. The deposition of lamellar bone, however, was minimal.

The conditions in the bone near vessels were of special interest. On the level of a connective tissue partition, directly in front of the cochlear



Fig. 6—"Blue zones" around a vessel, which is ruthlessly perforating old bone, no cementum line between the blue areas and the old bone, embedded in a collodion preparation (spec. 560/10), hematoxylin-eosin stained, seen with Lertz objective 6a, eyepiece 6 X, magnified 265 1.

bone, there was a cavity filled with normal marrow, from which vessels penetrated the bone of the labyrinthine capsule. Figure 6 shows such a vessel, leading from old normal marrow into a resorption cavity. The wall of the canal connecting both cavities was stained deep blue with hematoxylin. The blue area was not set off from the contiguous bone by a line of cementum. Toward the vessel, the blue area gradually continued as an eosin-pink osteoid zone. The resorption cavity was almost completely filled with new shell bone, which was set off from the old bone by a line of cementum. The primarily deposited new bone had the same structure as that of the surrounding bone. Toward

the lumen, the new formation went over into a granular crumbly zone. The lumen itself was lined with a narrow ribbon of osteoid tissue surmounted by a few osteoblasts.

The objection may be raised that these conditions are to a certain degree normal. For this reason, two more pictures will be discussed showing the relation of vessels and bones in this case of osteodystrophia fibrosa.

Figure 7 illustrates another area in the same section. A vessel leading into a resorption cavity had ruthlessly perforated an old lamellar



Fig 7—A vessel leading from an old marrow into a resorption cavity lined with new bone formation, cementum line between the old and the new bone, the latter showing three zones: normal bone, blue zone, pink zone (osteoid), embedded in a collodion preparation (spec 560/6), hematoxylin-eosin stained, seen with Lertz objective 6a, eyepiece 6 X, magnified 285 1.

bone. The old bone showed peculiar changes toward the wall of the perforating canal, as well as toward the wall of the old normal marrow cavity: a granular crumbly zone, stained dark blue with hematoxylin, gradually changing over into old bone without a cementum line. This area continued as an eosin-pink zone. The bone cells no longer showed a halo of protoplasm here. It seemed, rather, that the plasma had become continuous with the plasma of the osteoid matrix. The conditions within the resorption cavity had a different aspect: a definite

cementum line separated the old bone from that newly formed. However, the new-formed bone here also passed gradually over into a granular crumbly zone. The bone cells were surrounded by a light zone of protoplasm. Some cells lay partly in the blue, and partly in the pink zone, the latter lining the resorption cavity. A typical osteoplastic marrow and numerous osteoblasts were observed within the cavity.

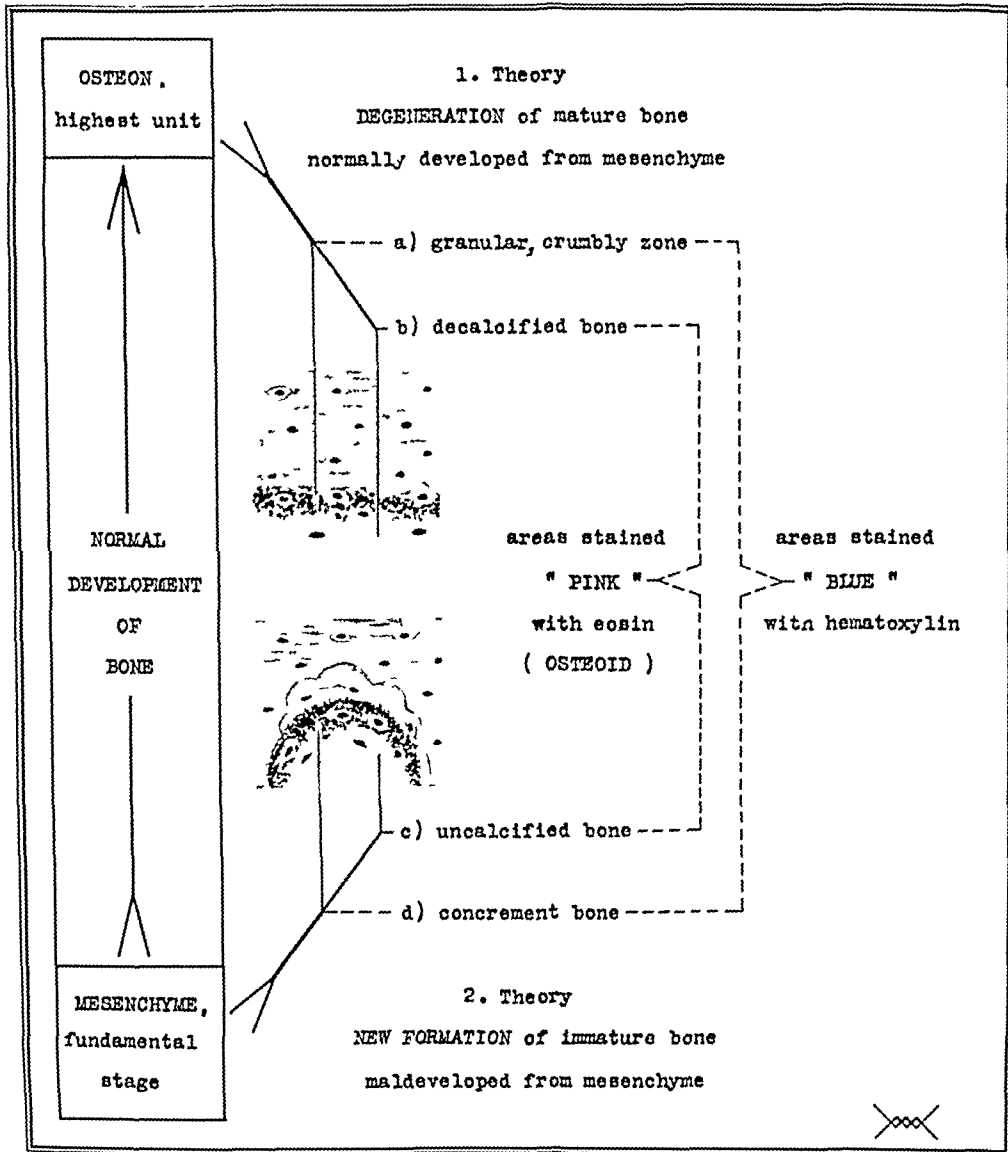


Plate 1—A graphic presentation of morphologically indistinguishable changes, with a theoretical explanation of their origin

Comment—One sees that new as well as old bone revealed the same histologic changes. The question arises: May these zones be traced back to the same or to a different origin?

To elucidate this question a graphic presentation of these morphologically indistinguishable changes, with a theoretical explanation of their origin, was prepared (plate 1). Theoretically two processes might be assumed to explain the origin of the blue and the pink zones.

(1) degeneration of mature bone normally developed from mesenchyme and (2) new formation of immature bone maldeveloped from mesenchyme. It is probably exceedingly difficult to prove which of the two possibilities holds in the various locations, since an adequate staining technic for the differentiation of the two processes is not had.

The difficulty lies in the fact that one is dealing with an interruption—at the moment of death—of two processes moving in opposite directions (decalcification and calcification). Moreover, it is conceivable that both directions of movement cross a common point. In reality, at this point there would be no chemical difference at all. Let me demonstrate this condition with a simile: if one takes a snapshot of a wheel slowly moving to the right and another of the same wheel in the same position, moving to the left, one obtains two identical pictures, which do not reveal the direction of the movement.

Thus, for the time being, one may answer this question only with probability or with "intuition," as Wittmaack stated. I should like to regard the areas which lie in bone not separated from the surrounding bone by a cementum line as "degenerated" bone. However, when the zones under discussion are situated in a substance separated from the surrounding bone by a cementum line, one is probably dealing with a new formation of maldeveloped bone. One has here a case of osteodystrophia fibrosa. It is possible that the dystrophy attacking the bone by means of the vascular system creates a disturbance in old bone (degeneration, von Recklinghausen, he also may be consulted concerning the relation of osteodystrophia fibrosa to osteomalacia) as well as in new bone in its primary stage of development (malformation). As I said, the effect as seen in the stained specimen, might be the same.

Since newly built bone may be diagnosed by the cementum line (figs 6 and 7, plate 1, second theory) one might, in this case, speak of a malformation. Malformation is a mere probability, for it might also be possible that the newly built bone had previously normally reached maturity and then secondarily become degenerated. In opposition to such a conception, however, stands the fact that malformation of new bone developing from mesenchyme is a common accompaniment of osteodystrophia fibrosa (fig 8), as I have pointed out in my German paper (1929), and as mentioned earlier by Monckeberg and Konjetzny.

In case a cementum line is visible the condition may be interpreted with fair probability. But there are cases in which a cementum line is not clearly observed (fig 9). However, here, too, one may be dealing with a formation of new bone. Figure 9 shows the bone conditions in relation to the internal acoustic meatus. The path of the eighth nerve lies below the level shown in this picture. One sees a vessel surrounded by new bone and a cementum line. The blue areas extend

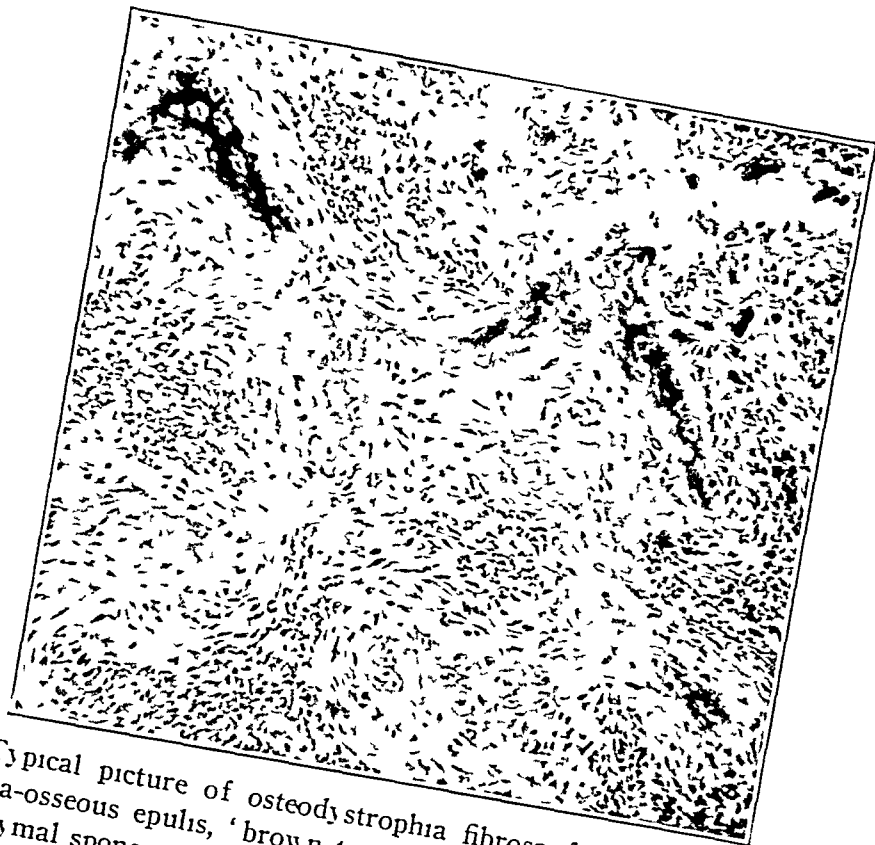


Fig 8—Typical picture of osteodystrophia fibrosa from the pseudotumor of the jaw (intra-osseous epulis, 'brown tumor,' hamartoplasia), giant cells, blood filled mesenchymal sponge, fibrous marrow, fibroblastic osteoid tissue, fibroblastic bone formation ("fibroblastic nucleus"), the latter being the result of maldifferentiation, embedded in a collodion preparation (spec 550), hematoxylin-eosin stained seen with Leitz objective 16 mm, eyepiece proj II magnified 100 1

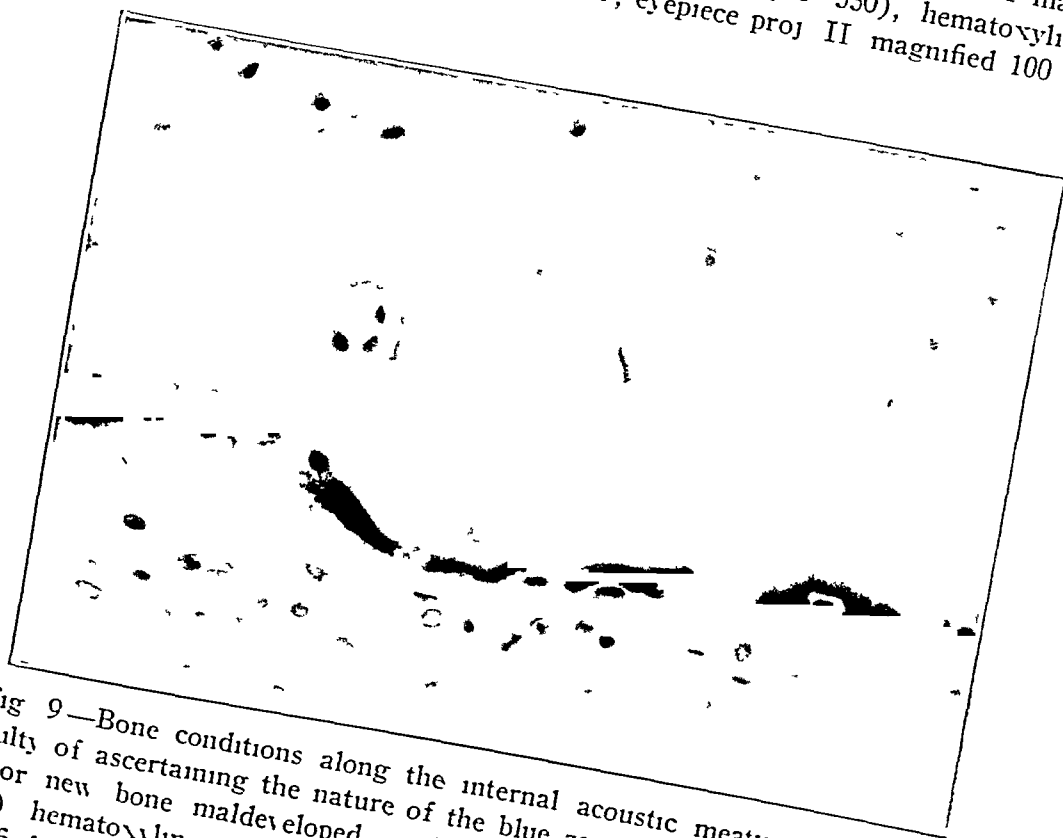


Fig 9—Bone conditions along the internal acoustic meatus, illustrating the difficulty of ascertaining the nature of the blue zones, whether old bone degenerated or new bone maldeveloped, embedded in a collodion preparation (spec 560/4) hematoxylin-eosin stained seen with Leitz objective 6a, eyepiece 6 X, magnified 530 1

alike along new and old bone. In some places, this boundary is sharply delimited; nevertheless, no distinct cementum line is visible. Thus, the difficulty consists in determining whether this is new or old bone, a malformation or a degeneration. Plate 2 has been constructed as an attempt to clarify this problem in case the intercellular substance of

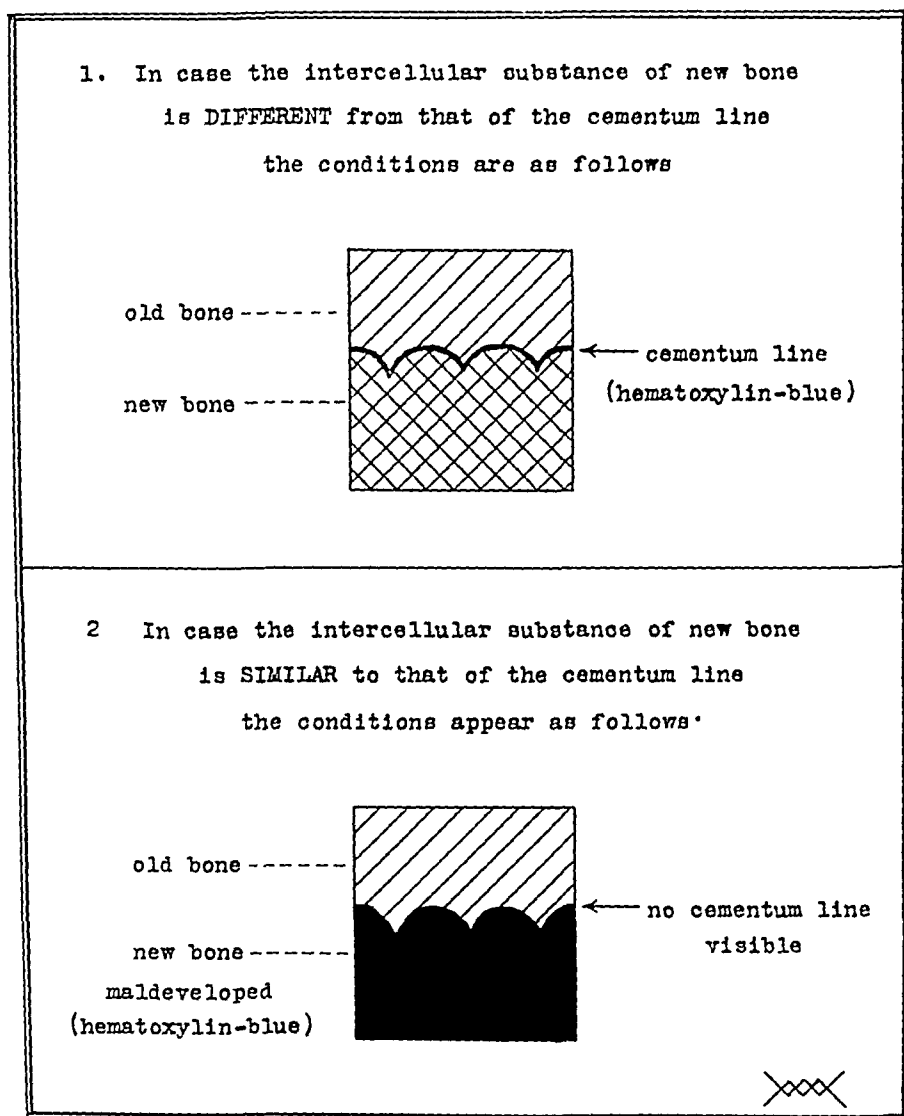


Plate 2—A graphic presentation of the relations between the presence of new bone and the visibility of the cementum line

new bone is different from that of the cementum line, then one will find a cementum line staining blue with hematoxylin, as usual. However, in case the intercellular substance of new bone is similar to that of the cementum line then a cementum line may be invisible. This would rob one of the last means of identifying new bone in a

hematoxylin-eosin stained section. As a matter of fact, in osteodystrophia fibrosa one observes changes of the intercellular substance which lead to the establishment of such dark blue granular, crumbly, cemented bone (fig 8, Langenskiöld and Weber also may be consulted). Therefore, it must be kept in mind in making observations in those regions (fig 9) where the outline is definite and forms lacunae that one may be dealing with new bone, even when no cementum line is visible. Perhaps examinations by polarized light will here decide the question. The cementum lines of ground sections of normal bone cannot be seen in polarized light under gypsum plate "red I order"³. In fact, the whole picture is determined by the course of the fibers. This method of polarization (with gypsum plate) is in reality the only method for a selective "staining" of the directions of fibers. Any difference in the course of the fibers, therefore, will determine whether the bone is old or newly deposited in lacunae.

Therefore, the question of the direction of movement (decalcified or uncalcified bone?) ought to remain in the background until a practical technic for differentiation has been established. Rather, one should constantly be aware of the fact that in both cases bone of inferior quality is present.

In the present case of generalized osteodystrophia fibrosa, the bony capsule of the labyrinth was in a stage in which processes of resorption exceeded those of new formation. This stage corresponds with the hypo-ostoticporotic form (Christeller). It is possible, however, that the new formation might have come to exceed the resorption, in which case one would have been dealing with a type corresponding to the hyperostoticporotic form present in the other bones of this animal. Since a sclerotic form may develop from the hypo-ostotic, as well as from the hyperostotic, form, it represents the end-result or healing stage (Christeller).

What relation the changes observed in the labyrinthine capsule of the present case of osteodystrophia fibrosa actually have to otosclerosis, will become evident from a general comparison of the two diseases.

THE HISTOGENESIS OF OSTEODYSTROPHIA FIBROSA IN COMPARISON WITH THAT OF OTOSCLEROSIS

THE QUESTION OF DYSTROPHY AND DEGENERATION

Morphologically, it is much more difficult to predict the future development of an initial stage than to interpret from an end-picture how it has come about.

³ This plate consists of a wedge of gypsum which placed between the crossed Nicol prisms produces interference colors of so-called first order (Schaffer J. Lehrbuch der Histologie und Histogenese Leipzig Wilhelm Engelmann 1922 p 103, and Kohler A. cited by Weber 1927).

How does the disease begin? This is the most difficult problem of osteodystrophia fibrosa, as well as of otosclerosis. Naturally, the histology at the beginning is closely related to the etiology.

In the case of osteodystrophia fibrosa the conclusion is that the disease is probably the result of a chronic local or general dystrophy, and that in this manner the localized as well as the generalized forms may be explained. This view does not stand in opposition to the many theories of its origin. Without doubt it is the vascular system that acts as a mediator between the dystrophy and the degeneration. Especially has venous stasis been held as a cause (von Recklinghausen, Pommer, Lang and others). It would be reasonable to assume a degeneration of bone in the neighborhood of vessels from a dystrophy referable to a venous stasis. However, as convenient as this conception might be, the so-called halisteresis of bone cannot be positively proved morphologically, since we lack, as yet, exact technical methods (Axhausen, Christeller). Thus the question must remain undecided, in spite of the classic investigations of von Recklinghausen.

The same problem arises in regard to otosclerosis. Here also one finds several authors who hold a dystrophy or rather a softening of the bone (aseptic necrosis, Gray) responsible for the initiation of the process. The theory of venous stasis is championed by Eckert-Mobius, Gibelli, Grunberg, Heynin, Lange, O. Mayer (1911), Wittmaack and others. The enlargement of the haversian canals has been regarded as the initial stage in the development (Drury, Picobraschensky, Simeoni). Recently, Doderlein took a stand in regard to this important question of degeneration. He came to the conclusion that in the beginning the bony substance undergoes regressive changes. In agreement with Wittmaack, he regarded the "blue coats" around the vessels—first described by Manasse—as such degenerative processes. However, he did not believe, as Manasse did, that the "blue coats" represent new bone. In this respect one must probably agree with Doderlein, although for the present, proof can hardly be given (the discussion in the foregoing paragraph may be seen).

In my case, also, one observed blue areas along vessels, which may be identified with the "granular, crumbly zone" of Pommer and must be interpreted as evidences of degeneration.

In regard to the primary stage of dystrophy and degeneration in osteodystrophia fibrosa, as well as in otosclerosis, one finds practically the same observations and the same theories and arguments.

While a certain diversity of opinion characterizes observations on the first step of the development in both diseases, a greater unity of opinion is evidenced in observations on the next stage—the reaction

THE REACTION

Resorption—Resorption by osteoclasts is an important step in the normal development of bone. In the case of osteodystrophia fibrosa, one can demonstrate that an unknown cause (dystrophy?) leads to a stimulation of the functional bone-building system, which finds its expression in the increased appearance of giant cells. They produce the spaces in which the consequent processes take place.

This could be observed well—in the case under discussion—in the pseudotumors of the jaws. The labyrinthine capsule also showed such cavities resulting from resorption.

The same conditions have been described for otosclerosis. According to Escat (stage of osteo-spongiose), Gay, Heyninx (la phase ostéo-spongieuse), Lange, Leimoyez, Mayer and others, the space in which the otosclerotic focus later appears is produced by giant cell resorption.

Let me emphasize here that such increased lacunar resorption is never found in rickets or osteomalacia. Therefore, concerning this stage of development, I must confirm Mayer when he says "it is quite certain that otosclerosis shows no relationship with osteomalacia or rickets, as certain American authors have believed."

In this connection, the question of the perforating vessels is of importance. From investigations of Pommer, Lang and others, it is known that vessels also exhibit the ability to erode by means of their walls. Concerning osteodystrophia fibrosa, these conditions were studied by von Recklinghausen, Pommer and Lang. For otosclerosis, Wittmaack, Eckert-Mobius and others have stressed the importance of the vascular system as a resorptive factor. Perhaps one might here fittingly call attention to the old "neospongification theory" of Siebenmann.

It is not certain in what manner the resorbing action of osteoclasts and blood vessels may be explained. Recently, the view seems to predominate (Siegismund) that in the case of lacunar resorption (giant cells) the bone must be in a state of readiness for such resorption. This "readiness" (degeneration?) produces the primary stimulation that leads to the appearance of the osteoclasts. Possibly the difference between resorption by blood vessels and resorption by osteoclasts lies in the fact that the resorptive activity of the vessels produces a degeneration of the bone but it is not dependent on such degeneration, while giant cells probably remove only such material as has previously suffered degeneration. Here again one notes the primary importance of the vascular system.

Thus it is seen that there is a correlation of osteodystrophia fibrosa with otosclerosis in regard to the phase of resorption both by giant cells and blood vessels.

In both diseases, mesenchymal tissue appears with the resorption

Appearance of Mesenchymal Tissue—The fundamental stage of normal bone development is represented by mesenchymal tissue (Hueck). It is closely related to the vascular connective tissue (Heizog).

In osteodystrophia fibrosa, the cavities produced by giant cells are immediately refilled with such mesenchyme. In the areas of most severe involvement (i. e., intra-osseous epulis), this tissue appears as a mesenchymal sponge filled with blood (Monckeberg). In the case under discussion, such a mesenchymal germinal tissue was also observed in the resorption cavities of the labyrinthine capsule.

I have interpreted the appearance of this mesenchyme as a result of stimulation of the functional bone-forming system (reaction). Teleologically expressed, the bone-forming apparatus mobilizes its reserve forces—as far back as the youngest stage—in order to repair the defect. Thus, in osteodystrophia fibrosa, the appearance of mesenchymal tissue (reticulated marrow, sponge of "brown tumors") is the expression of the ability of reparation. In contradistinction, the reticulated marrow (Geistmark) of Molle-Bailow's disease and scurvy must be regarded as a sign of exhaustion of the bone-forming system.

In regard to osteodystrophia fibrosa, the question has been discussed whether it is the mesenchymal tissue or the giant cells that appear first. If one considers that the newly appearing tissue is closely related to the connective tissue of the vessels (Heizog), one may assume that the mesenchymal tissue and the giant cells arise simultaneously. For didactic purposes only the stage of resorption has been treated first.

Similar conditions are found in young otosclerotic foci. Here, too, one sees this loose mesenchymal tissue together with giant cells (Escat, Panse, osteoplastic marrow, Mayer).

From an analysis of the next stage it will become evident that in otosclerosis, as well as in osteodystrophia fibrosa, the newly proliferated mesenchymal tissue possesses the ability of reparation.

THE REPARATION

Progressive Stage (Differentiation)—Fibrous Marrow. In the course of the formation of normal bone, a differentiation of cells and an increase of the intercellular substance develop from the fundamental stage, the mesenchyme (Weber, 1928). Pathologically, the same process repeats itself in osteodystrophia fibrosa. At first, fibrous marrow develops as the preliminary result of the differentiation of the proliferated mesenchyme. This fibrous tissue appears in such abundance that the disease has acquired the designation "fibrosa." Besides the elements destined to form bone, in osteodystrophia fibrosa the mesenchymal

elements provided for the formation of the vascular system take part in the differentiation. This process is referable to the pluripotentiality of the mesenchymal tissue (Hueck, Heizog). Now, the histologic picture bears a certain similarity to granulation tissue. In fact, the intra-osseous epulis of the jaw, representing osteodystrophia fibrosa, has been pointedly designated as a granulation tumor (Haupl, Lang and others). The great similarity of this histogenic stage to inflammatory granulation tissue prompted von Recklinghausen to regard the nature of this disease as that of an inflammation and to employ the term "ostitis" fibrosa.

In the labyrinthine capsule, also—in the case under discussion—I observed such "granulation tissue" in the cavities produced by resorption.

Recent authors (Rehn, Stenholm, Pick, Weber and others), however, have shown that one may forego the conception of an inflammation in the genesis of the so-called "ostitis fibrosa" if one regards a dystrophy (a disturbance of the metabolism) as the primary etiologic factor. Thus the new designation "osteodystrophia" fibrosa came about.

In otosclerosis, likewise, one finds such a progressive stage, a differentiation from mesenchymal tissue, which at first also appears in the form of a fibrous marrow. Practically all comprehensive papers on otosclerosis emphasize this fact. Good illustrations of this fibrous tissue have been given by Lange, Manasse, Mayer, Wittmaack and others. Mayer said "The foci of otosclerosis should be regarded as circumscribed forms of fibromatosis." In otosclerosis, exactly as in osteodystrophia fibrosa, there is a participation of the elements destined to provide the vascular system, in the course of the differentiation of the mesenchyme. In this process, likewise, a sort of "granulation tissue" originates. It was just this correspondence with osteodystrophia fibrosa that induced Manasse and Mayer to emphasize a possible correlation of the two diseases. Manasse said (translated) "For I was impressed by this similarity, and von Recklinghausen also at first was of the opinion that the designation ostitis fibrosa would be appropriate. After a more thorough discussion in connection with my sections he gave preference to the term 'ostitis chronica metaplastica'." But the assumption of an inflammation and the designation "ostitis" have become permanently established neither for otosclerosis (Manasse) nor for ostitis fibrosa (von Recklinghausen). As shown in the foregoing paragraphs, recently a chronic dystrophy has been held responsible for the origin of otosclerosis (Brunner and others). Thus without the assumption of an inflammation, one can comprehend the histologic changes of otosclerosis. However, it is still uncertain whether otosclerosis may not also originate from a true inflammatory granulation tissue.

In both diseases, there has been found this stage of reparation just described, for both diseases the theory of an inflammatory origin ("ostitis") has been advanced and the designations "fibrosa" (von Recklinghausen) and "fibromatosis" (Mayer) have been offered

The differentiation of the mesenchyme, however, does not cease at this point, but continues as a rule

Formation of "Nucleus" In normal bone development, an increase and differentiation of intercellular substance appears with a more or less pronounced differentiation of the mesenchymal cells (Weber, 1928) This increased intercellular substance seems rather to be the product of a humoral or colloid chemical process (Leriche and Policard) than the result of an activity of already differentiated cells The differentiation of the matrix is perhaps principally chemical From such differentiation, evidently two different products result, which, when later calcified, represent, on the one hand, the so-called "calcified connective tissue" (fiber bone, Weidenreich) and on the other, the "calcified cartilage" These two hard substances I have designated as "nuclei," since they act as a foundation for the consequent deposition of lamellar bone (shell bone Weidenreich)

In pathology, in general, one recognizes again this stage, so far as it concerns the calcified connective tissue, as "metaplastic" bone formation or rather "fibroblastic nucleus" formation (Weber, 1928), thus the term "bone" is eliminated, since it is questionable whether one is dealing with "calcified" or truly "ossified" connective tissue (Weber, 1928)

In the present case of osteodystrophia fibrosa, no fibroblastic "nucleus" formation could be observed outside of the osteogenic area, which could possibly be interpreted as "heterotopic nucleus" formation However, in the region of the endosteum and periosteum the fibroblastic "nucleus" formation was increased These conditions could be particularly well observed in areas of local enhancing of the osteodystrophic process (pseudotumor of the jaw, fig 8) Between the cells of the "granulation tissue" a hyaline (eosin-pink) substance appeared, which has been designated as "fibroblastic osteoid," as the first step of "fibroblastic nucleus" formation In later stages, this substance becomes calcified The color changes from pink to blue-gray in a hematoxylin-eosin stained section The cells and their canaliculi, embedded in the intercellular substance, could be demonstrated fairly well by thionin picric acid This type of bone formation was formerly designated as "metaplastic bone," which has been regarded as typical for osteodystrophia fibrosa (metaplastic malacia, von Recklinghausen) Since it is known, however, that, in considering the origin of the new fiber bone, one is not dealing with a direct transformation of one tissue into another, but rather with the flaring-up of a differentiation of a

newly proliferated mesenchymal tissue, preference should be given to the term "fibroblastic" bone formation (Bauer, Christeller, Gruber Meyer, Weber, Weidenreich). This type of "nucleus" formation was enhanced in osteodystrophia fibrosa. The cavities formed by resorption were filled with a new hard substance, frequently in excess (hyperostoticporotic form, thickening of bone).

In the labyrinthine capsule proper of the present case, the "nucleus" formation was not increased to as great an extent as that observed in the pseudotumor of the jaw. But in the resorption cavities of the petrous bone, hyaline islands were observed which should be designated as "fibroblastic osteoid" islands. Therefore, the changes in the labyrinthine capsule alone must be regarded as a hypo-ostoticporotic form.

The "cartilage nucleus" formation played no important rôle in the long bones of this case, since at the beginning of the disease the cartilaginous remnants of the long bones had for the most part disappeared, because of the age of the animal (8½ months).

In the labyrinthine capsule, however, more or less large cartilaginous remnants are invariably to be found, normally. These remains of cartilage in the present case, were in an active stage of transformation. The cartilage cells were opened, and the intercellular substance calcified. One had here an enhancing of the "cartilaginous nucleus" formation. It must be emphasized, however, that the cartilage was not of metaplastic origin, but rather a remnant of the original embryonic cartilage.

In the otosclerotic foci, one finds "fibroblastic nucleus" formation, as a rule (*geflechtartiger Knochen*, Mayer). Just as in osteodystrophia fibrosa, so in otosclerosis, a hyaline substance appears throughout the more or less differentiated connective tissue, which at first stains pink with eosin but later blue with hematoxylin, as can easily be recognized from instructive illustrations in the papers of Manasse, Mayer, Wittmaack and others. Thus, the similarity to osteodystrophia fibrosa may be ascertained. In otosclerosis, also, the "nucleus" formation, i. e., the appearance of calcified, ossified or sclerosed connective tissue, may exceed the normal, leading to a localized tumorous thickening of the petrous bone (hyperplasia, Mayer). Evidently, it is the intercellular substance that plays the leading rôle. From this point of view the calcification of the ligamentum circulare with a consequent ankylosis of the stapes—as observed in both otosclerosis and osteodystrophia fibrosa (Brunner Gray, Katz, Mayer, Nager) may be comprehended.

Concerning the stage of "nucleus" formation within the progressive phase of reparation, close analogies have been observed between these diseases in connection with each the question of "metaplasia" has frequently been discussed.

The progressive phase of repairation, however, is interrupted by regressive processes

Regressive Phase (Disturbances of Differentiation) —If the present diseases are in reality caused by a dystrophy, this dystrophy probably lasts throughout the further course of the disease, and continues its disturbing influence on the histologic processes, especially on the newly arisen differentiation

On the other hand, the theory has been propounded that the regressive changes may be traced back to a primary hereditary faulty mesenchyme (Mayer). In this case, the mesenchyme would entirely lack the ability to form the highest type of bone. As proof of this theory, blue sclerotics and osteopsathyrosis (osteogenesis imperfecta) have been offered (Bigler, Clemmison, Fraser, Gimplinger). However, since these mesenchymal disturbances are not a constant feature in all cases of otosclerosis, this question is not definitely decided as yet and further investigations appear desirable

In discussing the regressive phase, one should keep in mind that it is not a sharply delimited, independent stage of histogenesis. The various phases of the development do not necessarily appear separately. To clarify the nature of the relation of the diseases under discussion, however, I am treating the phases separately. In regard to the regressive phases of differentiation, I shall distinguish (1) the lack of differentiation and (2) the faulty differentiation

Lack of Differentiation The normal development of bone reaches its climax with the deposition of lamellar bone (shell bone, Weidenreich) on the primarily formed "nuclei" (Weber). This formation of shell bone occurs in the presence or as a result of the activity of osteoblasts, in epithelioid arrangement. The highest unit of bone development is the haversian system, the osteon

In the course of cases of osteodystrophia fibrosa which I have examined, it could be demonstrated at the point of climax that the highest unit of bone did not appear at all or, at best, as a qualitatively faulty formation, i. e., osteoid. The temporal bone also presented such narrow osteoid ribbons, while the deposition of real lamellar bone was lacking

The same conditions have been observed in otosclerosis. Here also, in the otosclerotic foci, there is no deposition of shell bone worth mentioning (Brunner, Mayer and others)

In osteodystrophia fibrosa, as well as in otosclerosis, one observes a lack of differentiation, recognizable by the absence or the defective development of lamellar bone

This lack of differentiation is accompanied by faulty differentiation which indicates the end-picture of the histogenic development

Faulty Differentiation The mesenchyme, closely related to the vascular system (Herzog), filling the resorption cavities is pluripotent. Its differentiation into bone is not the only process, one must also take into consideration the further development of the elements destined to provide the vascular system.

In my German paper (1929) I discussed the regressive changes in osteodystrophia fibrosa comprehensively. Therefore, only a cursory review of the conclusions follows. The young mesenchymal tissue, appearing in the course of osteodystrophia fibrosa, differentiates in a progressive way up to different levels. The progressive tendency exhausts itself and gives way to regression. As a result maldifferentiation ensues (Konjetzny). The products of this faulty differentiation I have designated as hamartoplasias. As hyperplasias they represent intermediate formations between true tumors and normal tissue on the one hand, and between inflammatory repair tissue (scar tissue) and normal tissue, on the other hand. In this connection, I mentioned the experiments in transplantation of embryonic tissue (Carell, Skubiszewski and others). The dense fibroma-like areas within the epulis of the present case must be regarded as such hamartoplasia (pseudofibroma). Likewise, the blue islands of granular, crumbly concrement bone represent such malformation. Beneath the periosteum of the long bones hyaline islands of dystrophic calcification were found. Such tissue previously observed, has been identified with keloid by Wulfigg and by Konjetzny as faulty or excessive formation. Within these islands of increased intercellular substance no nuclei could be demonstrated with either hematoxylin or thionin. They were designated as "maldeveloped" fiber bone.

The cysts within the 'brown tumor' may also be regarded as such malformations. They arise, presumably from those elements that are destined to form vessels. They may originate from cavities resorbed by giant cells which according to Lubarsch are "maldeveloped detached vessel buds," or from blood sinuses or lymph sinuses (malformation of vessel elements, Stenholm and Hueck may also be referred to). In the formation of these cysts the surroundings play an important rôle.

Since the changes of the labyrinthine capsule of the present case presented a hypo-ostotic form of osteodystrophia fibrosa no special conclusions can be reached concerning this stage of the process. A critical consideration of the observations is given earlier in this paper, together with the discussion of the observations made on the petrous bone.

Now, concerning otosclerosis are there also regressive changes? The investigations of Mayer are of special interest in regard to this question. In his lecture "The Pathology of Otosclerosis" he came to the conclusion that the otosclerotic foci originate through the patho-

logic growth which has been observed in connection with embryonic malformation "One could indeed include them with the hyperplasias which are the result of faulty development or lack of development" These few words reveal how extraordinarily close the relations are to osteodystrophia fibrosa if one remembers what has just been stated about the hamartoplasias occurring in this disease I shall discuss this aspect in greater detail later Simeoni Escat Grunberg, Manasse and others also confirm the idea that the newly built bone is of inferior quality (i e, malformed)

Thus the conception of maldifferentiation in otosclerosis has been found in the literature also Are there histologic proofs of this theoretical assumption? It has been observed that otosclerotic foci present remarkable histologic differences These differences may be explained, by assuming that the progressive phase is interrupted by regression at various stages According to Mayer, a fibrous form of otosclerosis exists, in which large areas of the bone are filled with fibrous marrow containing only a few cells This statement immediately leads one to a comparison with the fibroma-like areas observed in osteodystrophia fibrosa especially as they appeared in the intra-osseous epulis in the present case On the other hand, he mentioned also a sclerotic form The newly formed bone is hardened in a peculiar way The marrow spaces contain only a few cells or are filled with osteoblasts The matrix of this new bone, staining deep blue with hematoxylin, has been described as "reticulated" Its cells are large and irregular These islands of bone may be identified with the islands of granular, crumbly concrement bone and the malformed fiber bone as observed in osteodystrophia fibrosa (fig 8)

The principle of the comparison holds throughout In osteodystrophia fibrosa and in otosclerosis, "nucleus" formation occurs, during which the intercellular substance, as well as the cells, undergoes regressive changes A detailed comparison, however, reveals that slight differences may be present The bone newly formed in otosclerosis is blue (hematoxylin), to this all authors agree In regard to this fact, the question arises whether one is dealing with "bone" at all The difficulties evidently consist in our inability technically to diagnose the so-called fibroblastic "bone" as merely calcified or really ossified For this reason, I have chosen the term "nucleus" and thus eliminated the questionable word "bone" Without doubt, the chemical composition of the "nucleus" is the deciding factor Mayer expressed the opinion that the hematoxylin blue of the newly builded bone arises from an abundance of cementum In the progress of "nucleus" formation, no real fiber bone (geflechtartiger Knochen) has been found, but rather a malformation which could be designated as a "cemented connective tissue" The special feature of this malformation and the special com-

position of the intercellular substance might be explained by the extraordinary anatomic conditions of the petrous bone or by the nature of the dystrophy causing the regression

The histologic differences in various pictures of otosclerosis and the variations from the products of maldifferentiation in osteodystrophia fibrosa are in all probability referable to the different compositions of the intercellular substance. These variations, however, do not at all preclude in principle, at least, the designation of the end-products as hamartoplasias

Furthermore, Mayer observed a cystic form of otosclerosis as well as a vascular form. This reminds one of the appearance of cysts and blood lakes in the mesenchymal sponge and their relation to the vascular system in cases of osteodystrophia fibrosa, especially their significance for the question of "brown tumors" and the so-called epulis cystica and epulis teleangiectatica (Romer, Siegmund)

Thus, one finds the closest analogies between the two diseases in their regressive phases and their end-product

A comparison of the single stages of the complete development of both diseases leads to the conclusion the entire histogenesis in the one is identical with that in the other

NATURE OF OTOSCLEROSIS AS INFERRED FROM THE COMPARISON WITH OSTEODYSTROPHIA FIBROSA

HAMARTOPLASIA

The opinions of the authors in consideration of the nature of otosclerosis, seem widely divergent at first glance. On the one hand stands the theory that it is dystrophic and degenerative in its origin (Wittmaack, Brunner), on the other hand, the theory that it is a hamartoma (Mayer). The question arises whether the differences are actually too great to be bridged. The conclusions reached from the comparison of osteodystrophia fibrosa with otosclerosis seem well adapted to accomplish this

Otosclerosis is to be balanced against a local form of osteodystrophia fibrosa. From the standpoint of histogenesis, it is of less importance whether one is dealing with a truly localized process of osteodystrophia fibrosa or a partial picture (local enhancing) of a generalized form. The so-called intra-osseous epulis as observed in the present case is a formation that challenges a comparison with otosclerosis. From the investigations of Siegmund, it has been proved that the epulis represents a "brown tumor." According to Gaugele, Lubarsch and others, these "brown tumors," however, are not true blastomas, but rather pseudotumors or resorptive new formations. They have a mesenchymal sponge as foundation (Monckeberg, Konjetzny). As I have attempted to

demonstrate (1929) the appearance of the mesenchymal sponge should be regarded as a consequence of an irritation of the bone-building system. The initial stimulus is probably afforded by dystrophy, degeneration and subsequent resorption. On the other hand, the mesenchymal sponge represents the fundamental stage of the bone-forming process, whence a new differentiation commences with the aim of repair and the result of malformation. For this malformation, I have coined the term "hamartoplasia" in order to emphasize that one is not dealing with a congenital maldifferentiation (hamartia, Albrecht), either with a hyperplasia of such origin (hamartoma) or with a tumor (hamatoblastoma). In contradistinction the term "hamartoplasia" indicates a pseudotumor (hyperplasia) of bone which has developed by maldifferentiation from a mesenchymal tissue which is not a congenital remnant but a new appearance during life as a result of irritation of the bone-forming system.

From the analysis of the separate phases of the histogenesis, it has been shown that the development of a local focus of osteodystrophia fibrosa corresponds with that of an otosclerotic focus. It was shown that a special correspondence exists with epulis presenting the picture of osteodystrophia fibrosa, in fact, otosclerosis could be regarded as an "epulis of the petrous bone." Therefore, otosclerosis may also be conceived of as a "brown tumor," pseudotumor or resorptive new formation. In otosclerosis, also, one is dealing with a degenerative, reactive reparative process. Here likewise, one has the question of dystrophy and degeneration, and one has the resorption and the embryonic tissue. One has a flaring-up of differentiation, which gradually exhausts itself after having exceeded the normal measure (hyperplasia). In otosclerosis, in general, true lamellar bone is absent, and faulty differentiation occurs. The end-picture of otosclerosis should be regarded as the picture of hamartoplasia.

This opinion of the nature of otosclerosis does not stand in opposition to the theory that it is dystrophic in origin. Mayer also, in 1911, championed this theory, but later abandoned it in favor of his hamartoma theory. Against the latter, well found objections were raised especially by Brunner.

The differences of opinion found among authors concerned principally the bone changes in the vicinity of blood vessels. According to Mayer, however, the authors proceeded sometimes from different premises. Especially over the question of the "blue zones," heated discussions were raised. As I have attempted to demonstrate in the discussion of the changes, one must learn to distinguish more definitely between two pictures of different origin: (1) old, degenerated and (2) new, maldeveloped bone.

In regard to the question of hamartoma, I may also offer a solution. As I have attempted to show, the end-picture of otosclerosis reveals a malformation (hyperplasia). Thus far I agree with Mayer. However, I do not think that this malformation is necessarily a hamartoma. A hamartoma is a malformation from a congenital, embryonal germinal tissue. The histogenesis identical with that of osteodystrophia fibrosa and the literature show, however, that the embryonic tissue is newly proliferated as a result of irritation of the bone-forming system by dystrophy. This marks the fundamental difference between hamartoma (Mayer) and my term "hamartoplasia." For the origin of such a formation, the conditions are especially favorable in bone tissue because of its great ability to regenerate.

The conception of otosclerosis as hamartoplasia does not stand in direct contradiction to the other hypotheses of its pathogenesis, but rather represents a link with which these hypotheses may be connected. On the other hand, such a view has the practical advantage that it does not culminate in resignation, as the theory of hamartoma does. It, rather, is accompanied by the prospect of discovering the genetic laws which govern the progression from dystrophy to hamartoplasia. Without doubt, further research on the problem of the genesis will prove of the greatest significance for the etiology and the therapy of both.

OSTEODYSTROPHIA OTOSCLEROTICA

As a result of the comparison of the histogenesis of osteodystrophia fibrosa with that of otosclerosis, it is evident that otosclerosis is a localized osteodystrophia fibrosa, a local porotic hyperostotic form or, in the majority of cases, rather a sclerotic hyperostotic form. Thus the term "osteodystrophia otosclerotica" seems the most satisfactory for characterizing the process. From the standpoint of histopathology, only this localized form deserves the designation "otosclerosis" (genuine otosclerosis).

According to Siegmund, the symptom complex of osteodystrophia fibrosa develops whenever under certain circumstances bone comes to be resorbed. Blood vessels may act as mediators, leading to a degeneration of bone resulting in such a local form. The close relation between the otosclerotic foci and cartilaginous remnants suggests that the picture of osteodystrophia fibrosa may develop also in places in which cartilage becomes resorbed. Possibly in contrast with bone cartilaginous remnants are more sensitive to dystrophic influences giving way to resorption earlier than bony tissue in general. This conception in connection with the actual presence of cartilaginous remnants and the peculiar distribution of blood vessels would explain the selective involvement of the labyrinthine capsule and therefore the focal nature of otosclerosis.

Not all these true otosclerotic foci necessarily lead to ankylosis of the stapes. One may have the paradox, genuine osteosclerosis without clinical otosclerotic deafness.

As a local form of osteodystrophia fibrosa, otosclerosis must be classified in the group of metapoeitic diseases (Christeller), to which also Paget's disease and von Recklinghausen's disease belong as generalized hyperostotic porotic forms.

THE DIAGNOSIS OF "OTOSCLEROSIS" IN CASES OF GENERALIZED OSTEODYSTROPHIA FIBROSA

As shown in the foregoing paragraphs, in the recognition of the histogenesis of otosclerosis and osteodystrophia fibrosa the question of the distribution of the pathologic processes in the labyrinthine capsule may be eliminated. Under no circumstances, however, in the recognition of the genetic relations of osteosclerosis to generalized forms of osteodystrophia fibrosa may this question of distribution be neglected, since it is of the utmost importance for the clinical aspect as well as for the histologic diagnosis of otosclerosis.

What then is the possibility for making the diagnosis "otosclerosis" from the histopathologic standpoint in cases in which a generalized osteodystrophia fibrosa is present?

At first one may consider the generalized hyperostoticporotic form of osteodystrophia fibrosa occurring with pseudotumors and cysts (ostitis fibrosa von Recklinghausen). In regard to this form, otosclerosis may manifest itself as a local process. Such cases evidently were observed by Mayer, Jenkins and others. In this case otosclerosis itself represents a pseudotumor, possibly with cysts. One would then be dealing with an otosclerosis superimposed on a generalized osteodystrophia fibrosa (genuine otosclerosis superimposed on a generalized osteodystrophia fibrosa).

The diagnosis "otosclerosis," however, cannot be made from the histopathologic standpoint in the case in which the nature of the disease as a focal involvement of the labyrinthine capsule is not evident. Such conditions may be observed in von Recklinghausen's disease, if the changes themselves do not present the pseudotumor. The pseudotumor must then be found in another part of the skeleton, otherwise, one is not dealing with von Recklinghausen's disease but with Paget's disease.

According to Christeller, Paget's disease (osteitis deformans) represents the adult generalized hyperostoticporotic form of osteodystrophia fibrosa occurring without tumors and cysts. Concerning the organ of hearing as a partial picture of the bone system the changes within the labyrinthine capsule are identical whether one is dealing with a case of von Recklinghausen's disease without tumors in this region or a true case of Paget's disease. In either case, the diagnosis "oto-

sclerosis cannot be made from the histopathologic standpoint. Ankylosis of the stapes however may occur owing to the generalized involvement of the labyrinthine capsule. One would then have the paradox: otosclerotic deafness due to generalized osteodystrophia fibrosa without genuine otosclerosis.

In regard to the present case of osteodystrophia fibrosa observed in a dog one comes to the following conclusion. The skeleton showed a generalized hyperostoticporotic form of osteodystrophia fibrosa. The epulis of the jaw represented the pseudotumor and cysts. One was dealing with a case of von Recklinghausen's disease. The labyrinthine capsule however was involved in a form of a generalized hypo-ostoticporotic stage without pseudotumors and cysts. Thus one could not make the diagnosis 'otosclerosis'.

From the foregoing comment it is evident that one may diagnose "otosclerosis" from the histopathologic standpoint only in a case of von Recklinghausen's disease and then only in a case in which the otosclerosis itself represents the pseudotumor with or without cysts. The diagnosis "otosclerosis" in a case of Paget's disease is an impossibility from the pathologic standpoint.

SUMMARY

1 Both otosclerosis and osteodystrophia fibrosa represent a degenerative reactive reparative process. A dystrophy presumably through action of the blood vessels causes degeneration of the bone leading to irritation of the bone-forming system. This irritation manifests itself in resorption and the appearance of young mesenchymal tissue which is the fundamental stage of bone formation. From here differentiation goes on to the formation of fibrous marrow, fibroblastic osteoid and fibroblastic 'nucleus' (so-called fiber bone). The highest unit of the bone-forming system represented by lamellar bone (shell bone) does not develop. Regressive changes rather interfere with the separate phases of the differentiation. This leads to numerous mal-differentiations the product of which has been designated as hamartoplasia (not hamartoma) which as hyperplasia is a pseudo-tumor likewise observed as intra-osseous epulis and so-called brown tumors.

2 The typical focal otosclerosis is histogenetically identical with a local osteodystrophia fibrosa and may be regarded as a local hyperostoticporotic or local hyperostotic sclerotic form of osteodystrophia fibrosa an 'osteodystrophia otosclerotica'. It belongs to the metapoeitic diseases. Only the cases representing such focal involvement of the labyrinthine capsule ought to be designated as otosclerosis (genuine otosclerosis). In cases of generalized osteodystrophia fibrosa the diagnosis "otosclerosis" is possible from the histopathologic standpoint only in von Recklinghausen's disease (otitis fibrosa) and then only

in case the changes are superimposed and themselves represent as hamartoplasia the pseudotumor, with or without cysts (genuine otosclerosis superimposed on a generalized osteodystrophia fibrosa) The localization of the genuine otosclerosis in the majority of these cases leads to deafness due to ankylosis of the stapes (so-called clinical otosclerosis) It is possible, however, that some of these cases with typical histopathologic otosclerosis do not reveal the clinical aspect of otosclerosis, namely, ankylosis of the stapes (genuine otosclerosis in which a clinical diagnosis of "otosclerosis" is not possible)

3 In cases of generalized osteodystrophia fibrosa, the diagnosis 'otosclerosis' is impossible, however, from the histopathologic standpoint (1) if the changes represent a partial picture of a case of Paget's disease (osteitis deformans), and (2) if the changes are a partial picture of a case of von Recklinghausen's disease and do not present themselves as pseudotumor, the latter appearing rather at another place in the skeleton as "brown tumor" (i e, epulis) Such a case observed in a Boston terrier has been discussed in this paper It is possible, however, that these cases with no histopathologic otosclerosis may reveal the clinical aspect of otosclerosis owing to ankylosis of the stapes (clinical otosclerosis in which a histopathologic diagnosis of "otosclerosis" is not possible) As previously stated, these cases must be regarded not as otosclerosis, but rather as a purely generalized osteodystrophia fibrosa (clinical otosclerosis due to generalized osteodystrophia fibrosa without genuine otosclerosis)

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ENDOTHELIOMA OF THE LARYNX*

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NEW ORLEANS

During the last twelve years, I have observed and treated seven patients who had hemangio-endothelioma of the larynx. In the first case, I was at a loss to know what the nature of the tumor was until after histologic study. In the second case, I felt a suspicion, because of the previous experience, and in each of the remaining five cases I was able to present the specimen to the pathologist with a fairly accurate histologic description before his sections were made, and this simply because the characteristics of the tumor were in each instance so similar to those in the first two cases.

All my cases occurred in men, whose ages ranged between 30 and 45 years. Five of the cases were on the left side of the larynx and two on the right side. The patients' habits in point of use of the voice, coughing and consumption of alcohol, tobacco, pepper or hot liquids were extremely moderate or of such nature as not to impress me from an etiologic standpoint. One of the patients was a farmer, two were lawyers in civil practice, one was a traveling salesman of the type residing in the larger cities, one was a minister of minor position, one was a negro gambler and card player and one was a merchant who managed his business. These occupations seemed to be so varied as to have nothing particular in common. Physically, the patients were well developed, well nourished and healthy in all other respects. They had had the mild discomfort from which they sought relief for from three months to a year.

In every instance, the tumor occupied nearly the same spot, five times on the left side and two on the right.

The point of development was apparently just above the free edge of the arytenoid cartilage, halfway between the vocal process and the posterior extremity. The area of involvement was about the size of a green pea, and the tumor looked like a small hemorrhoidal tag, covered, as it was, by apparently normal mucous membrane, soft to the touch, that is, with the patient under suspension laryngoscopy and with the use of a feeler for palpation. It gave one the sensation of touching a tag of tissue which grows from a base that is slightly broader than the apex of the tumor, with a feeling of mild induration at the point of junction of the tumor with its base, as if the tumor were slightly

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terraced on its base. At the point of junction there was, in each instance, a tiny reddish ring around the tumor, as if there might be here a circular capillary somewhat larger than the other capillaries which might make up the tumor, though no such capillary formation was visible.

The patients were not hoarse. The cords were white, without injection of blood vessels, their approximation was accurate, and there was no lagging of motion, and yet each of these patients was conscious



Fig 1—Whole tumor, capillary type of endothelioma, showing a large blood clot at *A*, $\times 10$. The surface is covered with squamous epithelium.

that something was wrong about the larynx. They complained of voice fatigue and of a sense of fullness, as if some foreign body or growth was there. In no instance did the tumor give rise to any pain, either local or reflex, and it interfered with the voice only in those cases in which, after an incomplete removal, proliferation extended forward to the vocal process or over the free edge of the arytenoid cartilage, and then the voice was only feathery, because the cords even now approximated, but there was a small leak in the interarytenoid space. During

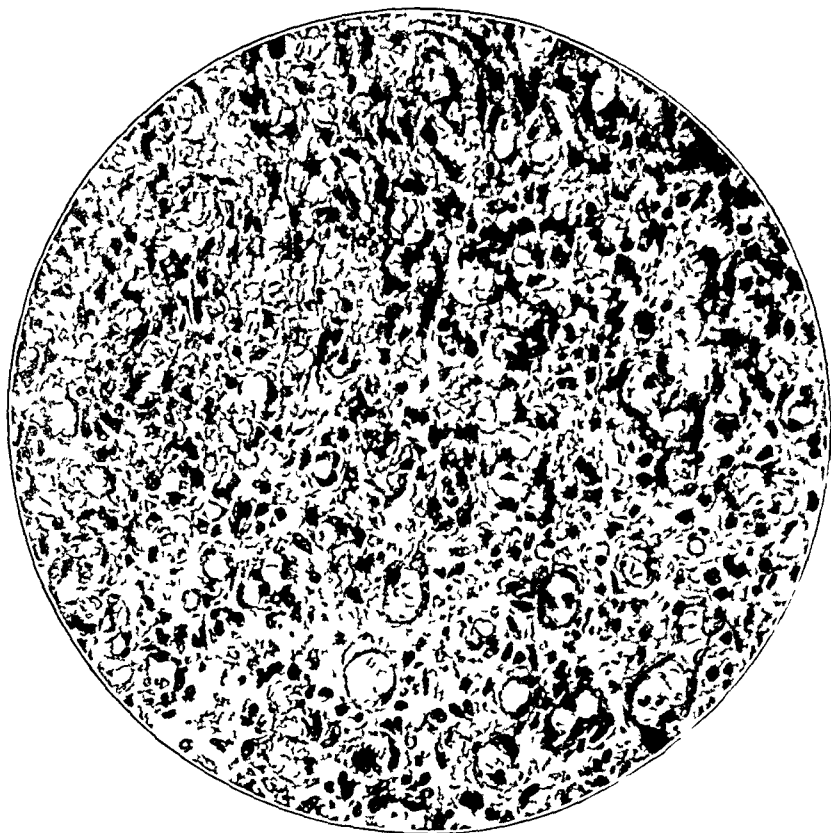


Fig 2—Section of the tumor shown in figure 1, $\times 275$ Marked proliferation of endothelial cells is shown, with formation of typical capillaries, some of which contain blood cells



Fig 3—Whole tumor of capillary type with infiltration into base, $\times 10$ Recurrence was prevented by coagulation of its base

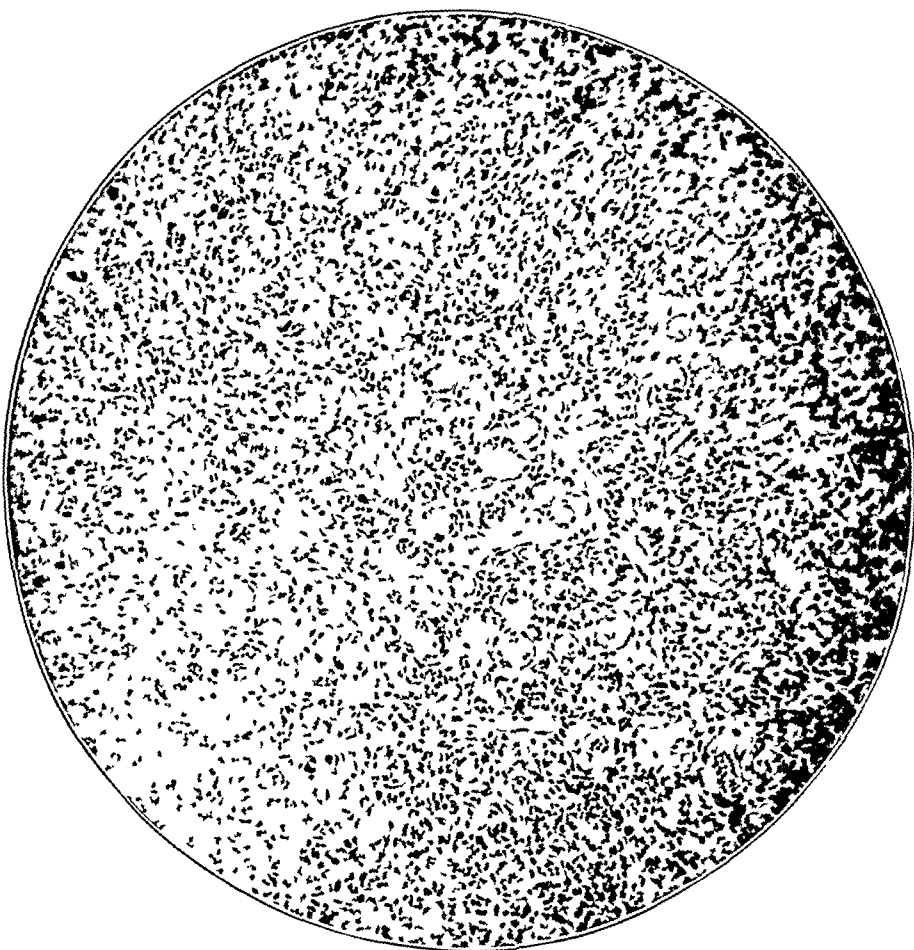


Fig 4—Tumor of capillary type with marked inflammatory reaction, $\times 60$
The edges are covered with squamous epithelium (*A*)

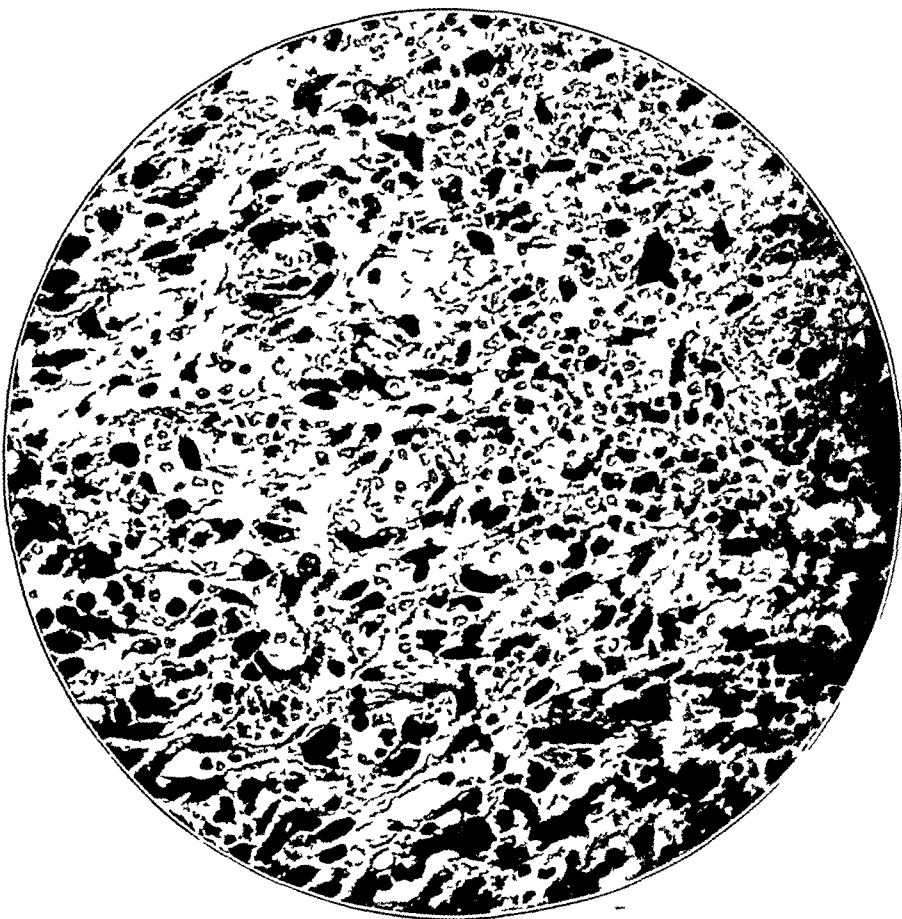


Fig 5—The tumor cells have large nuclei, indicative of more rapid growth
Many capillaries contain blood Magnification, $\times 275$

this phase of secondary proliferation which followed operative intervention, the tumor was nearly flat and appeared more like a pachyderma, except that the central portion was soft and looked like an ulcer on an elevated base. Here, too, one could observe the portion of the original lesion which had healed, and it was easy to see and feel that the scar was closely applied to the perichondrium. There was no evidence by sense of sight or touch to indicate proliferation in this area.

In the first case, I cut the tumor off just below the little red ring described, and covered its base with compound tincture of benzoin. In



Fig 6—Whole tumor of capillary type, $\times 10$

three weeks it had grown, it had not proliferated to its original size, but had broadened out at its base. In the meantime, Dr. John Lanford, pathologist at the Touro Infirmary, who made a careful pathologic study of these cases and also advised me concerning their surgical handling, had studied the sections carefully and made his diagnosis of "endothelioma of the capillary type."

I shall digress here to quote from the text as follows: "The lining cells of the blood and lymph vessels and subdural spaces arise from mesenchymal cells and are closely related to connective tissue, not only the embryology but also the physiology of endothelial cells

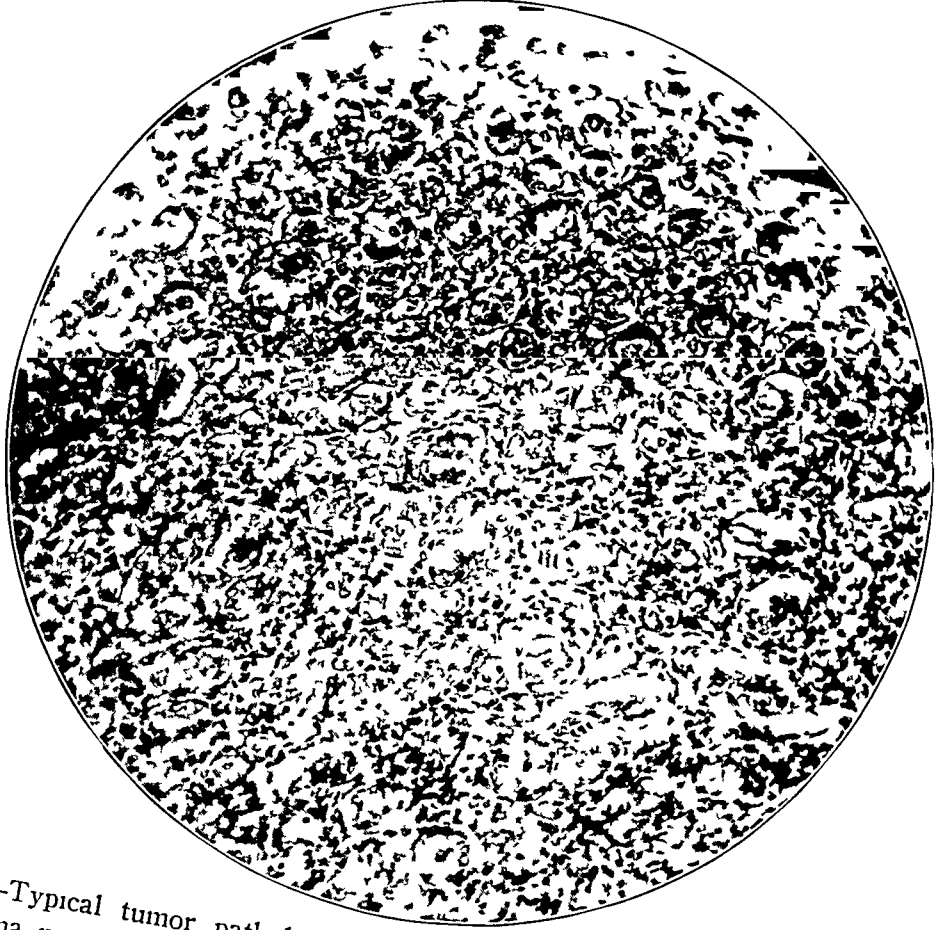


Fig 7—Typical tumor pathology, $\times 60$ Many thin walled capillaries and scanty stroma may be seen

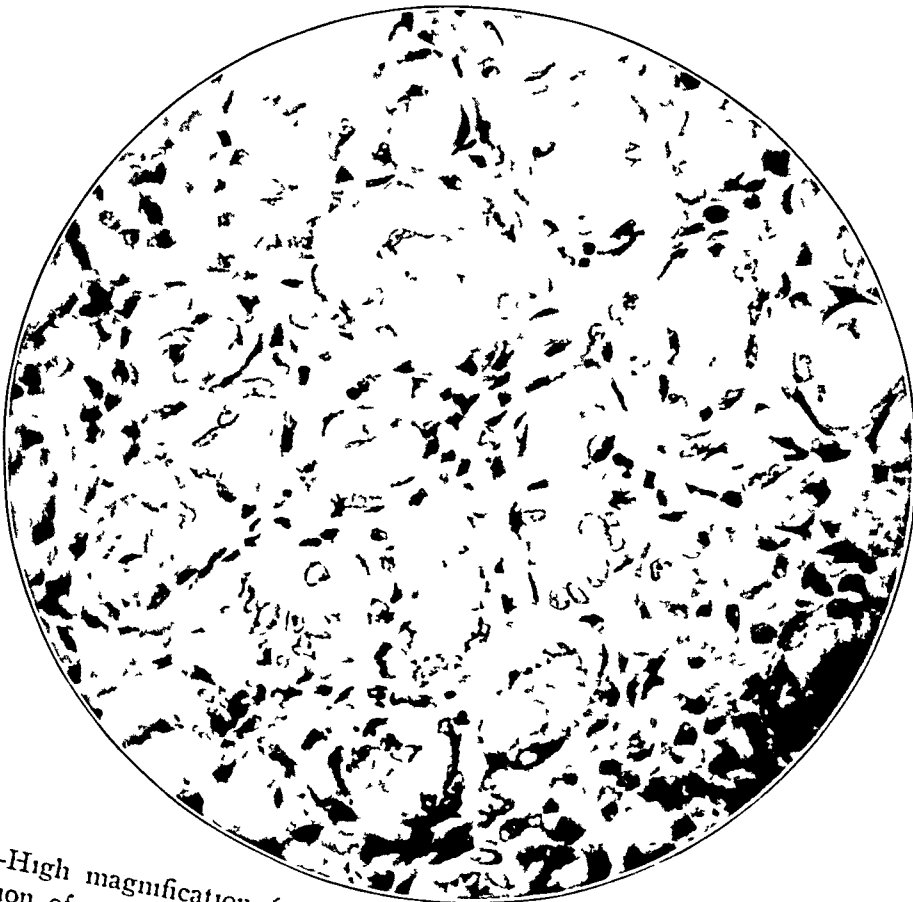


Fig 8—High magnification ($\times 275$) showing typical endothelial proliferation with formation of capillaries



Fig 9—Whole tumor of cavernous type, $\times 10$ The large blood-filled sinuses separated by supporting stroma, surfaces covered with squamous epithelium, should be noted

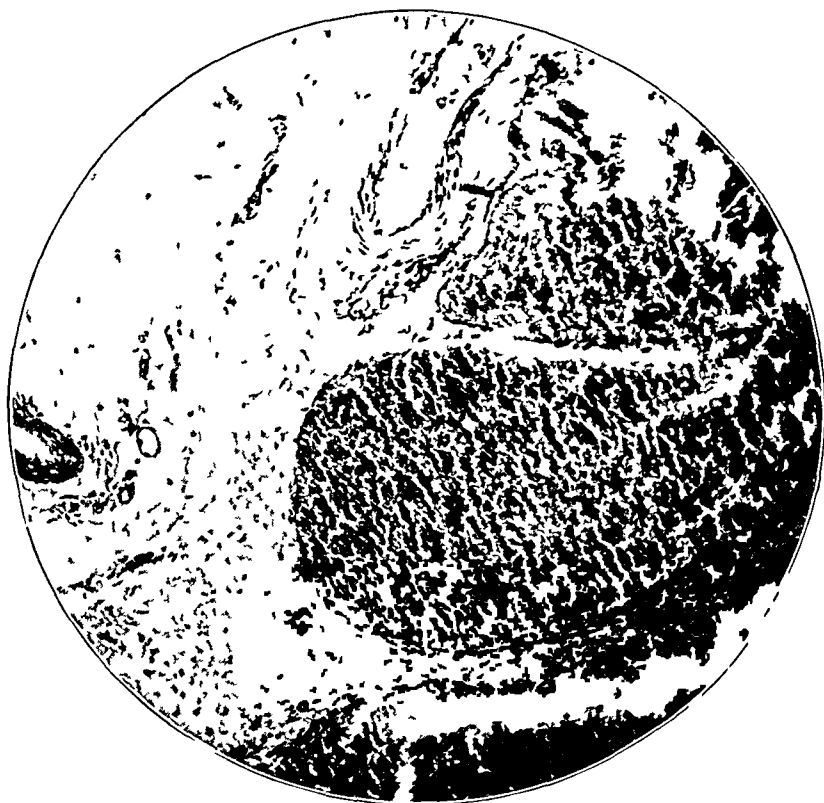


Fig 10—Large, blood-filled cavernous areas lined with a single line of endothelial cells and supported by a stroma variable in amount, $\times 60$ The normal capillary should be noted

places them in a position intermediate between epithelium and connective tissue ”

The cell is large and flat with an oval nucleus surrounded by a moderate amount of delicate cytoplasm. It gives rise to no intercellular substance, and its free border develops no cuticular surface. The function of these cells is to cover surfaces. Under normal circumstances, they possess marked phagocytic properties. They may desquamate and give rise to endothelial leukocytes. They seem to manifest the power

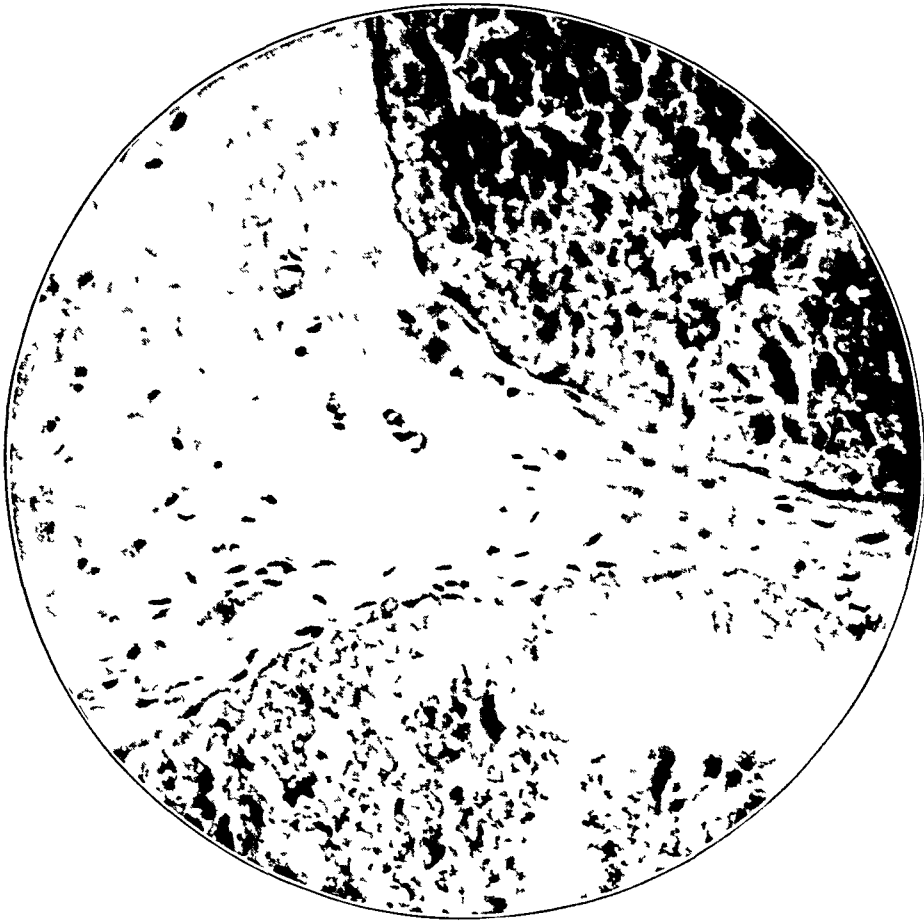


Fig 11—Higher magnification ($\times 275$) showing character of stroma and lining cells of caverns

of proliferation readily and under the stress of irritation or in the midst of inflammation they manifest this power in a lawless fashion and give rise to the tumors that I have observed

Endothelioma arising as it does from the small vessels or lymph spaces characteristically invades the surrounding tissue through these channels and does not split up the tissue as carcinoma does

I have noted two types in my cases the capillary and the cavernous. Other types are recognized when the tumor arises from lymph or subdural spaces

The growth is said to be slow but progressive, and it is noted for persistent recurrence, due to its infiltrating character, which, one must remember, is far in advance of the visible base, in all my cases, this seemed to be always toward the vocal process rather than away from it, contrary to what one conceives to be the natural flow of both blood and lymph

The endothelioma does not metastasize until apparently late in its history. None of my cases exhibited this phenomenon, but in similar tumors of the tonsil, soft palate and epipharynx there was metastasis to the bronchial lymph glands, the lungs and the liver. When the growth is observed in the latter locations, the prognosis is usually bad. All of the latter cases terminated in death within two years, differing



Fig 12—Whole tumor made up of blood-filled caverns and covered with squamous cells, $\times 10$

so much in this manner from the laryngeal cases, nearly all of which recurred locally, but all of which finally came to complete recovery

One must keep these facts well in mind if one is to succeed in surgical treatment in such cases. It took me some time to realize that this simple looking, apparently noninflammatory, hemorrhoidal appearing tag which gave so little discomfort was potentially malignant, and would recur quickly if I was too stingy in its removal. This faculty I exhibited in at least four of the cases and only then did I realize that the recurrence was due to my irrepressible desire to preserve for these patients their voices.

The method which finally yielded the best results was to operate under suspension laryngoscopy—with general anesthesia—and remove the tumor by dissection, circling the tumor broad of its base in an ovoid manner, with the apex of the oval extending almost but not to the tip of the vocal process the dissection to extend through the

perichondrium to the cartilage, and then to follow this removal by a careful actual cautery or diathermic coagulation of the entire margin of the wound, including its base. Hemorrhage was of no consequence. It would seem that as long as the tip of the vocal process is not destroyed, the function of the cords remains good. Also, when the cartilage is laid bare as in this instance it produces granulation tissue in excess of the margins, which are of soft parts. This granulation of the cartilage is red, bleeds easily and does not have the peculiar gray

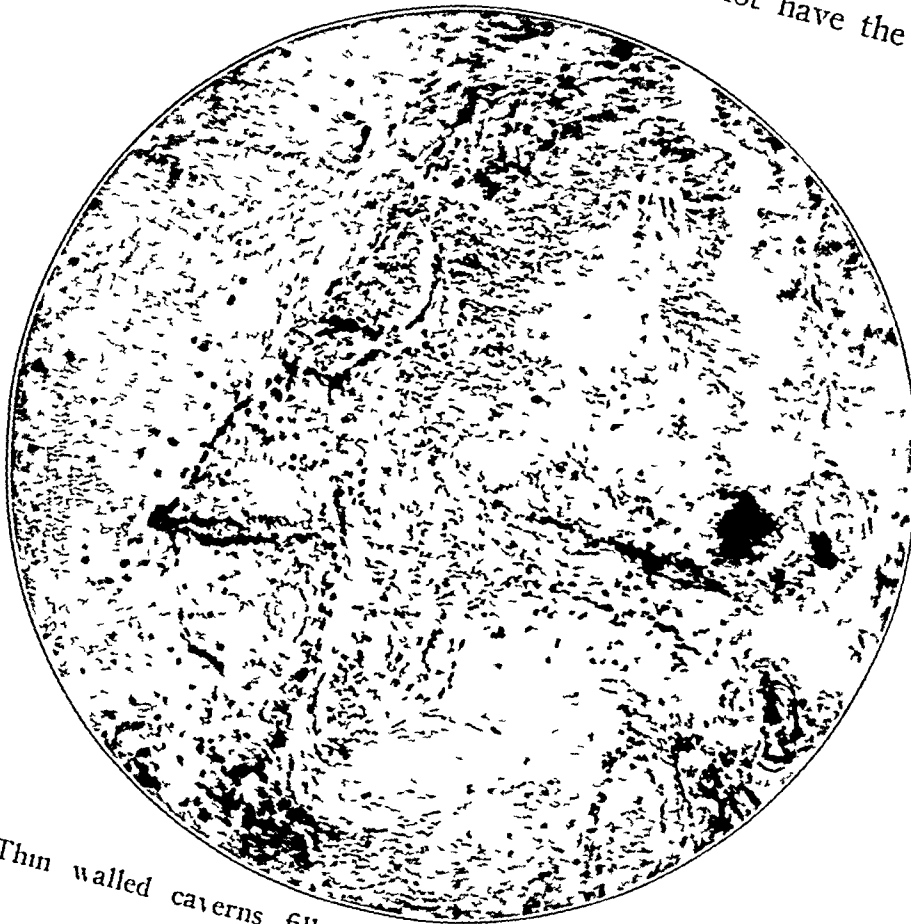


Fig 13—Thin walled caverns filled with blood and separated by delicate stroma, $\times 60$

look. It is easily wiped off or removed with a curet, and while it reforms, after one removal it can easily be controlled. It is difficult, however to differentiate this from an actual proliferation of the tumor cells, and one must watch carefully for induration extending from the base of the former operation, especially toward the vocal process.

It usually takes about three or four weeks for a coagulated wound to heal completely. This is a guide to the differentiation as well as to the induration. The final results in all of these cases have been excellent both from the standpoint of preventing recurrence and from that of preserving a functional voice.

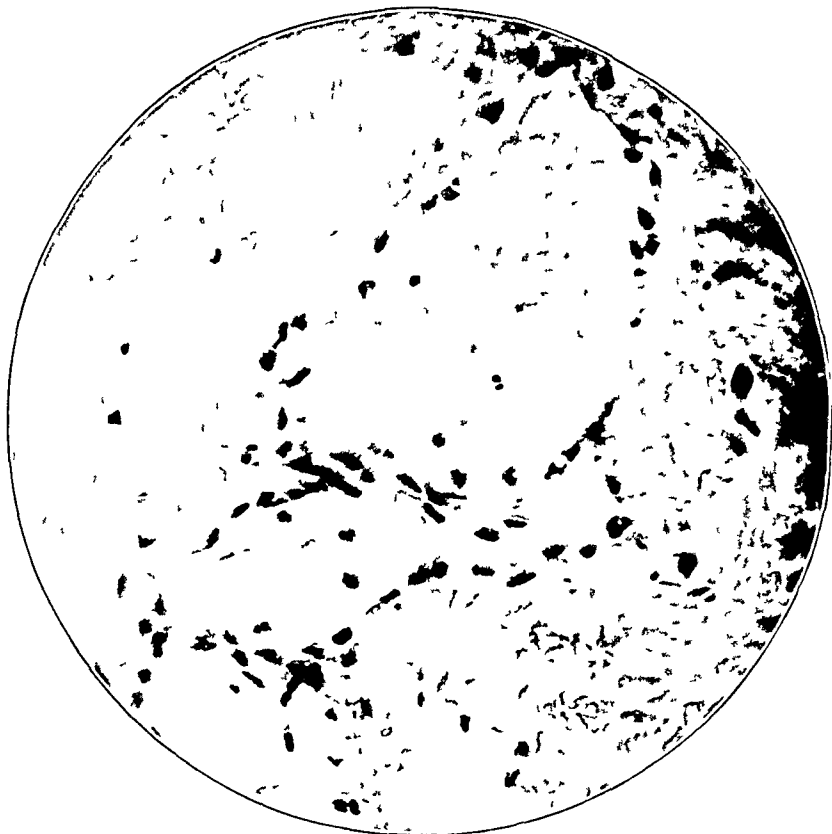


Fig 14—Blood vessel lined with a single laver of endothelial cells resting directly on delicate stroma, $\times 275$

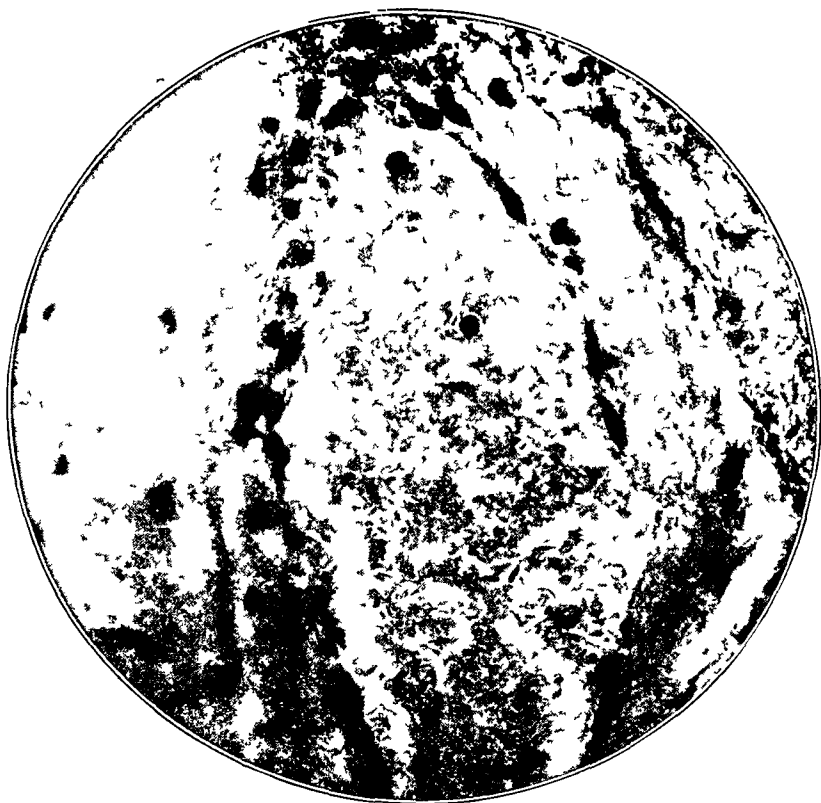


Fig 15—Blood vessels lined with a single layer of endothelial cells resting directly on delicate stroma, $\times 275$

It is now a year since the final healing in the last patient, and he is perfectly well thus far. All of the others have been well to the last date of observation. One died of apoplexy two years ago, but with no local recurrence and apparently no metastasis. The colored patient has not been seen for three years, so that I cannot vouch for him, but he was clinically well and had been so for two years. The remaining five are well.

While these little tumors are not to be compared with those I have observed on the tonsil, epipharynx or hard palate, I may point out that they are not blue or wine colored. They may grow from any location, though I have observed them only at the point described. This fact I have no explanation for, but it is of interest because the location seems to be of diagnostic value. I have never observed one within the cavity of the larynx.

It must be remembered that these tumors are potentially malignant and should be removed with that idea in view. If the field of operation is entirely in normal tissue, the bleeding will be of no consequence and the results satisfactory. Either the actual cautery or, probably preferably, coagulation offers additional safety against bleeding and cell proliferation. The best approach is by means of suspension laryngoscopy.

THE EFFECT OF CAMPHOR, EUCALYPTOL AND MENTHOL ON THE NASAL MUCOSA *

NOAH FOX, M D

CHICAGO

In 1927, I¹ reported the effects of menthol, camphor and eucalyptol on the vascular state of the mucous membrane. This consisted of acute experiments on clinical patients and laboratory animals, in which an attempt was made to determine the pharmacologic action of these drugs. I reported that menthol, even in dilutions as low as 0.5 per cent, proved irritating to the mucous membrane, causing a swelling rather than a constriction of these tissues as is popularly believed. On the other hand, camphor and eucalyptol in dilutions up to 5 per cent, although irritating to some degree, cause only a mild local reaction when sprayed into the nose. In this article I shall report the actual anatomic changes produced in the nasal mucous membrane of rabbits sprayed daily over a definite period of time. These experiments were designed to parallel the usual application of these drugs in practice. Liquid petrolatum solutions were used in the following concentration of solute: menthol, 1 per cent, menthol, 5 per cent, camphor, 5 per cent, and eucalyptol, 5 per cent. The animals sprayed with liquid petrolatum served as controls. Ten rabbits were used in each series, and they were sprayed once daily for nine months. At the end of that period the surviving animals were killed quickly with chloroform and autopsy was performed. Paraffin sections of the nasal mucosa were then made. The tissues selected were usually from the posterior or ethmoturbinate of the animal. This tissue was chosen rather than that from the anterior or maxilloturbinate because of the possibility of injury to this portion of the nose while the animals were being sprayed, since it was frequently necessary to get the nozzle of the nebulizer well into the vestibule of each animal's nose. A period of nine months was selected, because this represented about one fourth of the average duration of life of a rabbit. All rabbits used were about 1 year old (adults) and had healthy noses.

A daily history was kept of each animal, with observations as to the amount and type of nasal discharge if any, the general state of activity of the animal and the animal's weight. The solutions were

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* From the Departments of Pharmacology and Anatomy, University of Chicago

1 Fox, Noah. Effect of Camphor, Eucalyptol and Menthol on the Vascular State of the Mucous Membrane, Arch Otolaryng 6:112 (Aug) 1927

made up fresh each week, and each animal had its own nebulizer. To avoid contaminations, the nasal tips were sterilized once daily in 95 per cent alcohol.

OBSERVATIONS

A summary of the histories of these animals over the experimental period follows. In the group receiving 1 per cent menthol seven animals survived for nine months, the other three dying of involvement of the lung secondary to an upper respiratory infection. After the third week, these three animals showed until death a continuous nasal discharge, sometimes serous, but most frequently mucopurulent. One of these died in the thirty-fifth week of the experiment, the other two in the fourteenth and twentieth weeks, respectively. Autopsy of the animals that died prematurely invariably revealed pansinusitis with purulent bronchitis and pneumonia. At autopsy the surviving rabbits showed a purulent infection of the mucosa of the nose and sinuses.

The animals sprayed with a 5 per cent menthol-liquid petrolatum solution fared only slightly worse. From the third day of treatment their noses began to discharge first a serous, then a purulent secretion, they lost more weight than the first group, and were apparently very much annoyed by their treatment. The drug caused much sneezing and probably pain, since the animals struggled and squealed after they were sprayed. There were six survivors at the end of nine months. One of these, however, died of a generalized saprophytic infection in the sixth week. The nose, bronchi and lungs of this animal, though showing some evidence of inflammatory changes, were not primarily involved in causing death. The other three animals died in the twelfth, thirteenth and twentieth weeks of the experiment. Autopsy on these animals revealed observations similar to those noted in the previous group, namely, a purulent rhinosinobronchitis with numerous miliary abscesses and consolidation of lung tissue. When the surviving rabbits were killed, they were found to have acute inflammatory changes in the nose and sinuses. Two of these revealed areas of hyperemia in the lungs, one revealed an abscess of the parenchyma of the lung.

The group of animals sprayed with 5 per cent camphor had little difficulty until the fourth week, when they all developed a serous discharge from the nose. Except for three of the animals, which died, the surviving animals went through the experimental period exhibiting alternately a serous and a purulent nasal discharge, but seemingly otherwise not very much disturbed by the drug. They maintained their weight well, and gave little evidence that camphor irritated their noses. One of the animals that died caught its head between the wires in the door of the cage and strangled. The other two developed "snuffles," probably one from the other, since they were in the same cage. All of

these animals died before the tenth week. The animals killed at the end of the ninth month showed evidence of a purulent rhinitis, but the picture was less stormy than in the previous groups, and the accessory sinuses were very little involved. Two of these animals, though showing no evidence of bronchial involvement, had several small soft abscesses in the lungs.

The animals sprayed with 5 per cent eucalyptol responded very much like the previous group. Three animals died in the fourth week from "snuffles." The others seemed contented, ate well and maintained their weight. After the third week all had a nasal discharge, which

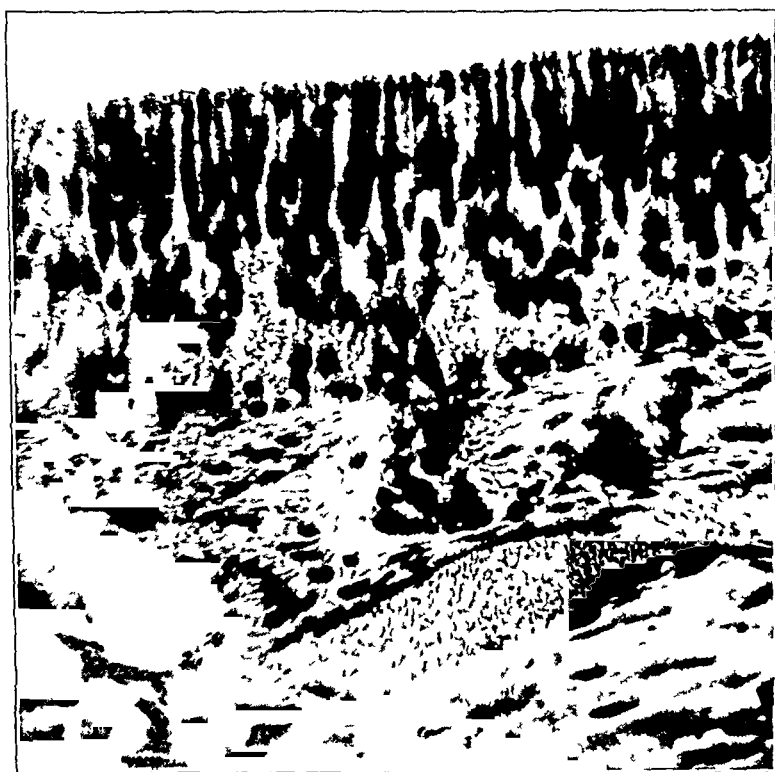


Fig 1—Effect of 1 per cent menthol

was serous at times and at other times purulent. At autopsy, the animals killed at the end of the experiment seemed to have slightly more nasosinus involvement than the group treated with camphor. About half had pus in the nasal sinuses, and three had small areas of hyperemia with incipient abscess formation in the lungs.

Four of the animals sprayed with liquid petrolatum died from "snuffles" before the fifth week. The other six acted very much like those in the previous two groups. At autopsy, however, the nose and sinuses were even less involved than those of the group treated with

camphor. In only one animal was pus found in the sinuses. Two of these animals had minute abscesses in the lungs.

To recapitulate, it may be said that the animals tested with 5 per cent menthol fared the worst, with 1 per cent menthol, better, with eucalyptol and camphor, about the same, but better than those in the 1 per cent menthol group. The animals sprayed with liquid petrolatum fared the best, though apparently some changes were occurring in the upper respiratory tracts.

It is my opinion that the abscesses of the lungs noted were possibly aspiration phenomena occurring during the spraying of the animals, since some animals of each group exhibited this condition.

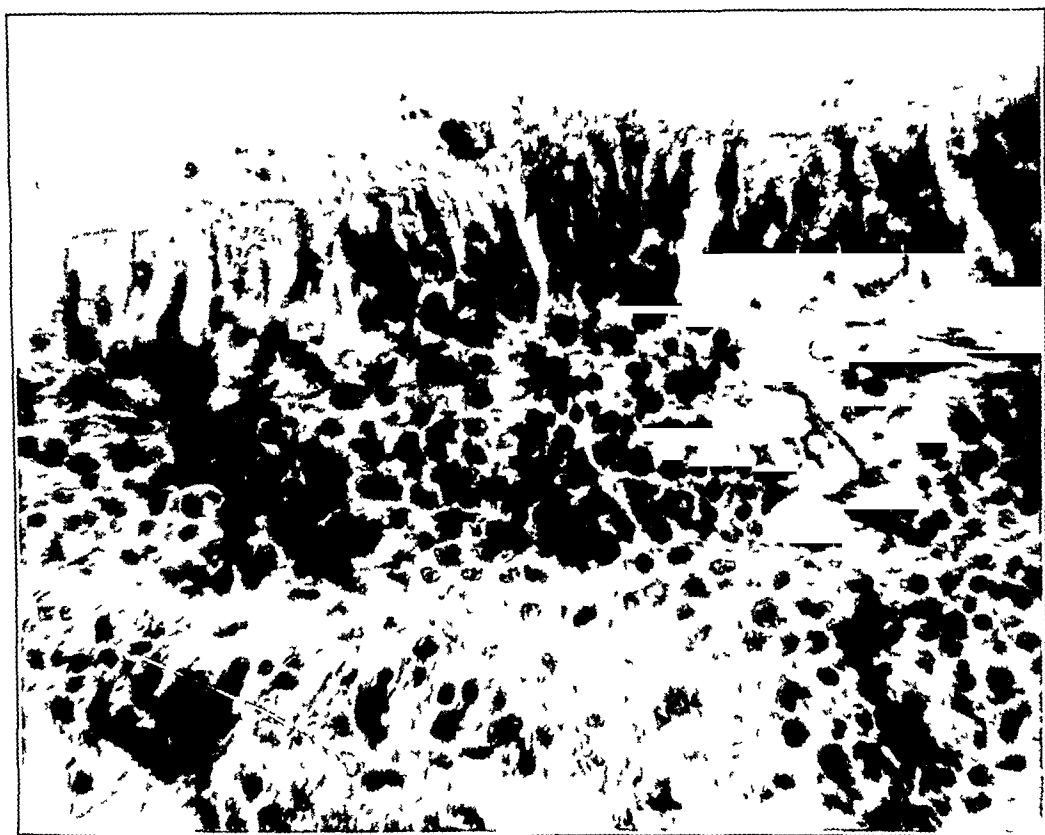


Fig. 2—Effect of 5 per cent menthol

Figure 1 is a section taken from the posterior turbinate of the nose of an animal treated with 1 per cent menthol. The epithelium is covered with exudate and is edematous, some of the cells have undergone necrosis. The tunica propria is infiltrated with round cells, its vessels are dilated and engorged, and the glandular elements are swollen. There is evidence of old tissue injury as well as of regeneration of new tissue.

Figure 2 is a paraffin section taken through the posterior turbinate of one of the group treated with 5 per cent menthol. It may be noted that actual destruction of the nasal mucosa has taken place, the tunica propria is infiltrated, and an abscess has formed in this area. The



Fig 3—Effect of 5 per cent eucalyptol



Fig 4—Effect of 5 per cent camphor

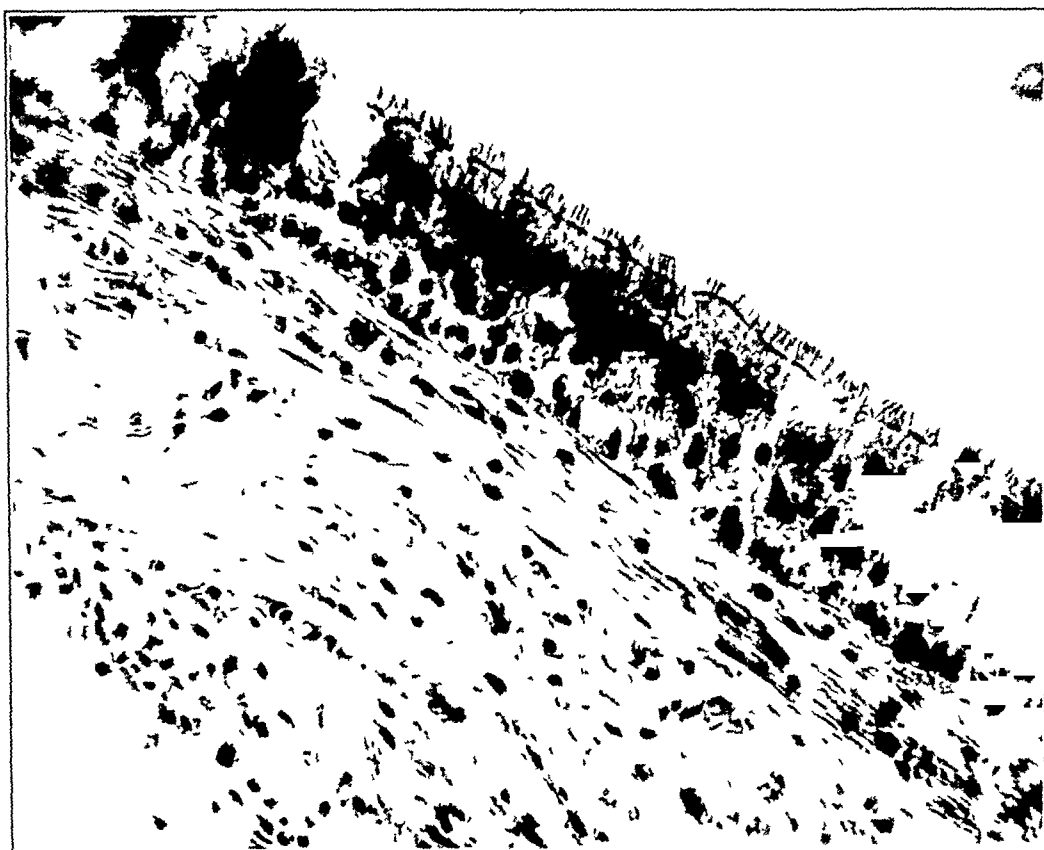


Fig 5—Effect of liquid petrolatum

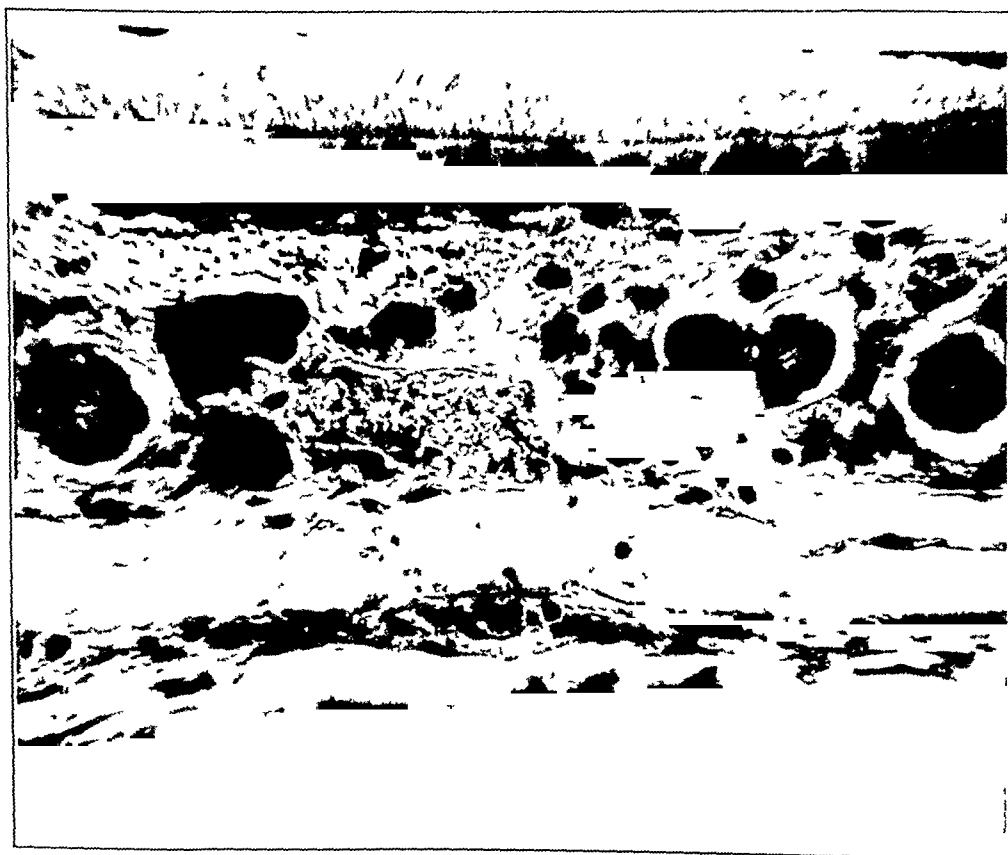


Fig 6—Normal nasal mucosa of a rabbit

vessels are engorged, the glands are swollen, and all the evidences of an intense inflammatory condition are present. Many small intra-epithelial abscesses are evident, with numerous grouped goblet cells dipping into the substantia propria.

Figure 3 is a section taken from the posterior turbinate of an animal treated with 5 per cent eucalyptol. The epithelium is swollen, but fairly well intact. There is some round cell infiltration and engorgement of the vessels of the substantia propria. A few intra-epithelial abscesses are present.

Figure 4 is a section taken from the posterior turbinate of an animal treated with 5 per cent camphor. Here, as in figure 3, there is evidence of mucosal injury, not as great, however, as that seen in the menthol sections. There is desquamation of the surface epithelium, but the submucosa is in fairly good condition.

Figure 5 is a section taken from the posterior turbinate of animals treated only with liquid petrolatum. Even here there is evidence of mucosal injury, although no other drug was used. The surface epithelium is desquamated, and many polymorphonuclear leukocytes and plasma cells are present. There are few polymorphonuclears in the substratum. There is a tendency toward new growth of epithelium.

Figure 6 is a section taken from the posterior turbinate of a normal animal for comparison with those previously described. The differences are at once apparent.

CONCLUSIONS

- 1 When applied to the nasal mucous membrane of a rabbit for nine months, menthol used in dilutions as low as 1 per cent causes some degenerative changes.

- 2 When applied to the nasal mucosa of a rabbit, menthol in 5 per cent dilutions causes definite destructive changes throughout all layers of the nasal membrane.

- 3 Five per cent eucalyptol and 5 per cent camphor have some deleterious effect on the nasal mucosa of a rabbit when used daily for nine months.

- 4 Liquid petrolatum apparently also exerts a deleterious effect on the nasal mucosa of a rabbit when used for nine months.

FURTHER OBSERVATIONS ON DENTAL CARIES AS A CONTRIBUTING FACTOR IN MAXILLARY SINUSITIS *

GORDON BERRY, M D

WORCESTER, MASS

A year ago, I proposed to the members of the American Laryngological Association that 60 per cent, and conceivably 80 per cent, of patients with paranasal sinus disease would show some form of dental caries in the antral bony floor. I had investigated 152 consecutive antral cases with rather special reference to the subjacent teeth. The matter was difficult of proof, but it seemed reasonable to conclude that if there was an abscessed tooth just under a suppurative maxillary sinus and if the dental infection in all probability antedated the sinus infection, one might consider the trouble to have originated in the tooth. In that case, as the condition became more advanced, the infection would pass

TABLE 1—*One Hundred Fifty-Two Cases of Maxillary Sinusitis and the Possibility of Their Origin in Dental Caries*

Per cent of cases	Origin in Dental Caries			
	Not Possible	Possible	Probable	Proved
	11	41	30	18

from the tooth to the antrum, to the ethmoid sinuses and perhaps to the frontal sinuses, being carried there by blowing or by the slower process of membranous degeneration and change. Table 1 gives a summary of my observations.

The 11 per cent without possibility of origin in dental caries represented cases of sinusitis in which all the teeth seemed healthy. The 41 per cent in which such an origin was possible represented the cases in which a dead tooth was in the floor of the diseased antrum but no x-ray or clinical proof was had of any active dental abscess. The "probable cases" were those in which not only a dead but an abscessed tooth was in the antrum floor, but final proof of the connection between the infection of the tooth and the sinusitis was still lacking. The "proved group" were the cases in which the sinus infection cleared after an established dental apical infection had been eliminated from the floor of the diseased antrum.

* Submitted for publication, Sept 16, 1929

* Read at Atlantic City, N J, before the American Laryngological Association, on May 21, 1929

A SECOND SERIES

The helpful discussion following my presentation pointed out to me that my effort at inclusiveness in my terminology and at brevity in my paper had led to a few justifiable misunderstandings of my meaning. Furthermore, I did not feel that this limited series had proved my proposition. During the succeeding eleven months, I have endeavored to study a second series, and to study it more in detail, in an effort to support or deny my original conclusions. Of 746 new patients in the office during this eleven-month period, there have been 81 with maxillary sinusitis. Eight of these were children of less than 18 years of age. In the first series there were nine. These children offer possible confusion by reason of differences in individual diagnosis and differences in climatic influence throughout the country. In an effort to be more specific, I am confining this consideration to the 73 adults. Each adult's case was diagnosed as one of antral trouble through the standard observations: history, congestion or polyp of one or both

TABLE 2—*Seventy-Three Additional Cases of Maxillary Sinusitis and the Possibility of Their Origin in Dental Caries*

Form of Maxillary Sinusitis	Origin in Dental Caries				Total
	Not Possible	Possible	Probable	Proved	
Acute	4	7	3	1	15
Chronic	2	17	24	15	58
	6	24	27	16	73

sides, a nasal suppurative discharge from the middle meatus, localized pain, a shadow over the affected sinus, a corroborating roentgenogram when I was in doubt, and sometimes an exploratory tapping and irrigation. The teeth were all carefully transilluminated. Then the case was referred for tests of dental vitality and a roentgen examination, the report and films being returned to me for study.

Table 2 gives the summary of this investigation, the same grouping being used as in my first series.

Twelve of the sixteen "proved cases" had fistula into the antrum after the abscessed tooth in the floor had been extracted. With healing, the trouble in the antrum ceased. There was one case in which a dental extraction was followed by such a fistula, but no previous trouble in the antrum could be demonstrated, this case was not included in the series. Table 3 sets forth the results reduced to percentages without fractions.

Deductions—Some of the patients came to the office but once or twice, others went to their dentists for dental extractions and did not return, some were followed through to recovery. Conclusions cannot be absolute, but the work was undertaken conscientiously and does give

certain definite results. In only six of these adults, or 8 per cent, did I find no dead or abscessed tooth in the antral floor and no history of such being extracted. At the other end of my table, my last year's 18 per cent of "proved cases" is shown increased to 22 per cent. It is the remaining 70 per cent that introduces the uncertainty. Last year, I felt that the "probable group" could fairly be included in my estimate. This would give me a total for this series of 59 per cent in which the infection of the antrum was "probably" of dental origin. I know that this 59 per cent had in each case a demonstrable abscessed infection of the root of the tooth just below the involved antrum. Whether this demonstrable infection caused the antral infection is a matter of surmise, but it is a logical conclusion. This estimate comes very near the 60 per cent of my last year's estimate. There remains the 33 per cent in the "possible" column. This is debatable ground. I am content to leave it so, if I can gain for each of these "possible cases" in your own offices a careful consideration of the dead teeth as sources of the

TABLE 3—*Possibility of Origin of Seventy-Three Cases of Adult Maxillary Sinusitis in Dental Caries, Expressed in Percentages*

Form of Maxillary Sinusitis	Origin in Dental Caries				Total
	Not Possible	Possible	Probable	Proved	
Acute	5	10	4	1	20
Chronic	3	23	33	21	80
	8	33	37	22	100

antral infection. As the study of all dead but not demonstrably abscessed teeth progresses, I am finding that in many instances they are real trouble-makers. If the evidence justifies, these infected foci should be eliminated. Leading internists are taking this position. The results are justifying such extractions. Bacteriologic examinations of their root canals sometimes reveal forms of *Streptococcus hemolyticus*. Laboratory workers are finding such infections even in teeth that are dying but not yet devitalized. Gross evidence against dead teeth in the floor of a large antrum is yet harder to find, for any infection escaping from the dental canal has but a short jump before it reaches the antrum. Then a fistula is established and there is but little more bony necrosis that can show in the film. The infection seeps directly into the antrum, and its only exit is out through the nose. Any tooth that is immediately beneath a diseased sinus, and that shows dark on transillumination, should be viewed with intense suspicion. My plea is that the rhinologist make it his business to investigate such teeth and not rely on the patient's or the patient's dentist's cursory statement that all is well. The technic is simple. The whole procedure takes but a moment.

TECHNIC OF ASCERTAINING DENTAL CARIES IN CONNECTION WITH MAXILLARY SINUSITIS

For the examination of the sinus a dark room is necessary. It is easier if the routine examining room can be so used, then the patient remains in the same chair. The dental transilluminator is connected to the city electrical system through a small rheostat control. The lamp with the current at its maximum is used to transilluminate the frontal sinuses. Then it is used to light up the antrums, being placed first under the right lip outside of the teeth in the extreme upper posterior sulcus. The amount of light that comes through just below the right inner canthus is noted. Sometimes the amount of light seen in the right pupil is a help. The same procedure is carried out on the left side and is repeated on the two sides, if necessary. If the skull is thin, the rheostatic current is cut down so as to lessen the light and better differentiate shadows. Then the midpalate position is used, which permits a simultaneous study of both antrums. Placing the lamp in the orbit just over the edge of the infraorbital ridge and inspecting the hard palate on that side has not proved to be so satisfactory in my hands, but it is essential if there is any edema of the cheek. An idea of the ethmoid sinuses may be gained by looking in the nose during the orbital or the posterior dental position. The lamp should be shaded from the examiner's eyes, when necessary, by a super-

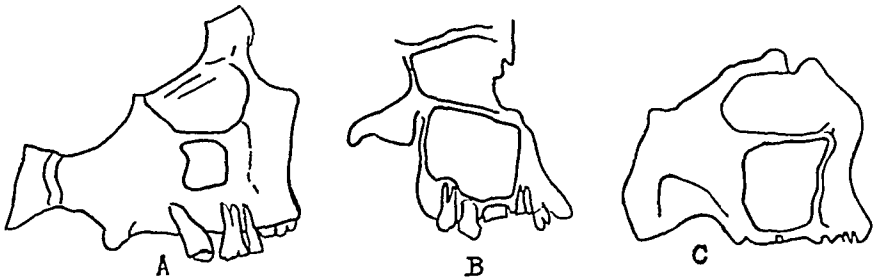


Fig 1—Tracings from anatomic specimens showing the antrum, with the orbit above and the teeth below. The nose would be to the right. A, the high antrum, B, the one with mounding teeth, C, the one with a root in the floor.

imposed thumb or by a short rubber-tube sleeve. This entire procedure takes but a moment and concludes the transillumination of the sinuses. Then, with the same equipment, but with the rheostatic current cut down to its minimum, the lamp is placed on the inside of and against each alveolar process, and the outside surface inspected for tooth root shadows. Next the lamp is placed outside of the alveolar process and the tooth roots are studied from the inside. Movement of the lamp helps to demonstrate shadows. A characteristic dead tooth is dark, while the other teeth are light. This darkness becomes a shadow that extends up the root of the tooth. If the dentist has treated the canal of the dead tooth with silver nitrate, the shadow is intense. In the case of an upper molar that is dying, I can sometimes discriminate which of the three roots is abscessed, so refined is the transillumination. Fairly frequently one finds a diseased tooth-root, or localizes a pathologic change in bone where the tooth has been removed and the gums have long since healed. Another type of shadow is one along the edge of the gums and up on the affected alveolar process, caused by pyorrhea. Here the pathologic bone change is superficial as against the deep pathology of an apical abscess. A recently extracted abscessed tooth leaves in the alveolar process the same deep-seated shadow as if the tooth were there.

Reliability of the Test—A pertinent question would be as to how sensitive and how reliable this transillumination is. As far as the maxillary sinuses are concerned, it has found many diseased antrums that only a clear film demonstrates, and the average roentgenologist cannot always show a good picture of the sinus. The dental transillumination rarely fails to find the bad teeth and even shows up a tooth that is beginning to go, and that only vitality tests in conjunction with other evidence can demonstrate. It is my custom to send my patients, when possible, to a dental roentgenologist for the x-ray pictures of the teeth and for careful review of the case. The patient takes with him my tentative rhinologic diagnosis and a list of the teeth in which infection is suspected. I estimate that this list names four of five diseased teeth correctly.

Illustrative Cases—Four case histories are appended, selected from the second series, as illustrative cases.

CASE 1—Miss C. K., aged 23, had an acute right maxillary sinusitis. This was one of repeated attacks which came on with each cold. Examination showed the right antrum darker than the left but not opaque, and only one tooth with a shadow over its roots, the upper right first molar. An x-ray film showed a definite abscess or granuloma over its anterior buccal root. This tooth had given

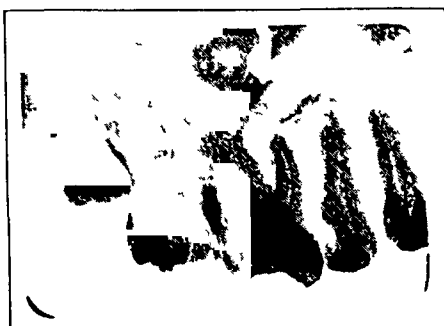


Figure 2



Figure 3

Fig. 2 (case 1)—First molar abscess breaking through the floor of the antrum.

Fig. 3 (case 2)—Abscessed bicuspid. The fistula into the antrum may be noted.

no pain, and she had supposed it sound and healthy. A skilled dental surgeon removed this tooth and found a small fistula leading directly into the antrum. I think of this as an early case which ultimately would have developed into a typical case of chronic suppurative antrum. I anticipate no further antral trouble, provided the bony necrosis in the antral floor is not so advanced as to continue to irritate.

CASE 2—Miss A. S., aged 22, came to me with a recent buzzing right-sided tinnitus, but with good hearing, some pus in the right middle meatus and more dropping back in the nasopharynx, a dark right antrum, and a dark upper right first bicuspid tooth. An x-ray film showed an abscess at the root of this bicuspid, which reached the floor of the antrum. The dentist thought, as I did, that he could see a break at this point in the bony floor of the maxillary sinus. The tooth was removed, but careful probing revealed no gross fistula. Three weeks later without any treatment of the antrum, the nasal pus had cleared and the right antrum transilluminated almost as clearly as the healthy left one.

CASE 3—Mrs J E C, aged 31, came with an acute right antral and frontal pain. This was the second attack, each time on the same side, and each attack following swimming and diving. The swimming and consequent chilling would probably be considered adequate cause, but the nose seemed as mechanically free on the right, excepting for the congestion, as on the left. Why then should it elect the right side? Transillumination showed not only a dark right antrum and frontal, but a dark upper right second bicuspid, the only bad tooth. The patient had been to her dentist regularly and had been assured that the teeth were doing well. The removal of this bicuspid made a small fistula into the antrum. She remained under the dental surgeon's care for a little while and returned to me three weeks later, I then found the tooth area healed, the nose clear and free, and the antrum clear on transillumination. The only treatment



Fig 4 (case 3) —A large unsuspected abscess just beneath the diseased antrum. Prompt and permanent relief followed extraction.

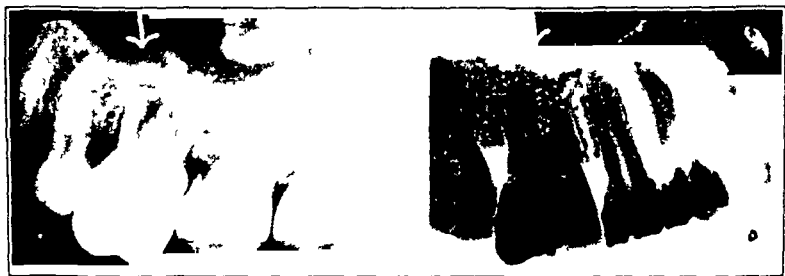


Fig 5—A case similar to case 4. Extraction of these two first molars resulted in a fistula into the left antrum. The infection cleared after three irrigations. Healing was prompt and there was no recurrence.

that she had had from me was a little ephedrine oil for the nose, to keep the tissues shrunk and the passage open. I asked her to be cautious at first about diving, but I am optimistic that she will have no more trouble from this source.

CASE 4—Miss F C, aged 45, had a chronic right maxillary sinusitis. There were several diseased, devitalized teeth, but especially did the upper right second molar look dark on transillumination and showed an abscessed condition in the film. This was removed, and the removal left a large fistula into the antrum. Probing through this fistula revealed granulations in the antral floor. I irrigated the antrum through this fistula five times in three months. She returned one month later with the fistula healed, the congestion of the nose gone, no suppurative discharge and the antrum transilluminating much more clearly though not yet quite so well as the left.



Fig 6—Recurring nasal colds were cleared by removing these unsuspected abscessed second bicuspid, which were constantly draining a little infection into the antrums



Figure 7



Figure 8

Fig 7—A recurring acute suppurative antrum was permanently cleared by sacrificing this useful well filled first molar. No abscess is apparent in the film.

Fig 8—There was no external evidence of this root other than a slight local shadow on transillumination. Its removal cleared the sinus infection and the headaches during the time that the patient was under observation.

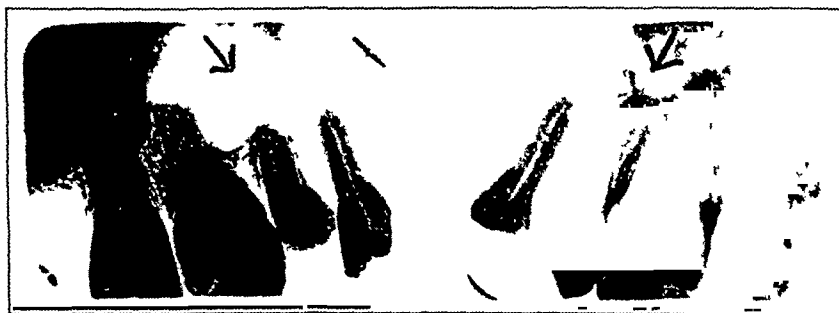


Fig 9—A bilateral radical antrotomy and ethmoidectomy had been well done. The nasal polypi and asthma had returned. Both these dead second bicuspid were removed. The symptoms cleared without other operative treatment. It may be noted how the diseased tooth roots reach the antral floor, though no definite abscess shows as the infection has escaped into the antrums.

COMMENT

Each patient came to the office for an infection of the antrum. Each patient supposed the teeth to be all right. In each case the dental transilluminator revealed, just under the floor of the diseased antrum, a tooth which appeared to be infected. In each case, the x-ray film showed the tooth to be abscessed. In three of the four, an alveolar fistula followed the careful dental extraction. At the time of writing, three were completely healed and the fourth was clearing, under little or no other treatment than the dental extractions.

CONCLUSION

In conclusion, I would impress on the Fellows of this association the ease and accuracy with which the teeth can be checked by transillumination and the considerable help that may accrue from the elimination of any dental infection in the floor of the diseased antrum. My arbitrary estimate of 60 per cent is not offered as proof of the exact incidence of dental caries in maxillary sinusitis in adults, but as an indication of the imperative need of reviewing the dental pathology in all recurring or chronic nasal and sinus infections. Many carefully assembled papers have been presented to help us in our endeavor to control these sinus conditions. It is only recently, since the science of dentistry has become so much more refined and since roentgenology has been more carefully applied to dental pathology, that this suspected connection between teeth and sinuses has been possible of exact demonstration. Members of this association have pleaded for broad specialization. I am adding my plea to that of the others. Dental apical infections are repeatedly affecting our cases. The careful rhinologist must consider gross dental pathology.

36 Pleasant Street

ENDOCRINE FEATURES OF INTEREST TO THE OTOLARYNGOLOGIST*

THOMAS P SPRUNT, MD

BALTIMORE

When this topic was first suggested, some doubt arose in my mind as to the advisability of its presentation, but on further consideration it seemed evident that since the endocrine glands constitute an important system of the body, especially in its development, its growth and in the co-ordination of its activities, they must affect all parts of the body and should be of interest in each of the medical and surgical specialties

It seems possible that in the daily work of the otolaryngologist the idea of an endocrinopathy may rarely obtrude itself, while the internist with his interest directed chiefly toward the general condition of the patient must keep it in mind constantly. It is true that the otolaryngologist is frequently called on for help by physicians and general surgeons in the diagnosis and treatment of definite endocrinopathies, and he should have a working knowledge of the more important endocrine syndromes and especially concerning the way in which the structures in his particular field may be affected by them. If I should be engaged chiefly in carrying coals to Newcastle, I hope that there may be some nuggets of value amid the general dross.

One may consider the relationships of the endocrine glands to the domain of otolaryngology from the standpoint of

(1) Physical juxtaposition and the possible results thereof. Thus, the thyroid, the hypophysis and the thymus are in close physical relationship with the structures of the otolaryngologist's special field. They may react on each other and may be affected by the same external agents.

(2) The influence of variations in the hormonal activity of the endocrine glands on the nose, throat, larynx and ears.

(3) The effect of otolaryngologic diseases on the endocrine organs.

It is convenient to take up each of the important endocrine glands in turn and to consider under each one the various relationships mentioned.

THYROID GLAND

The thyroid occupies first place in any general consideration of the endocrine glands. Its intimate physical association with the larynx

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and trachea and its embryologic relationship to the pharynx and tongue make it a matter of prime interest to the otolaryngologist

Simple Goiter —By simple goiter is meant, of course, an enlargement of the thyroid gland without definite evidence of toxicity. It is harmful to the patient chiefly from the pressure exerted on adjacent structures and from the cosmetic standpoint. The pressure exerted by the goiter may be in relation to its size, but a small goiter unfavorably placed may exert far more dangerous pressure than a larger one situated elsewhere. In its enlargement the thyroid may grow in different directions—upward, lateralward, forward over the chest and frequently downward beneath the sternum. More interesting just now are the retrosternal goiters and the particularly dangerous and relatively rare circular goiter that grows entirely around the trachea.

Dyspnea is an early symptom of obstruction and, according to Rienhoff,¹ may appear before the goiter has been recognized. An accompanying tracheal catarrh may roughen the voice and cause occasional coughing and clearing of the throat. Nodular goiter more frequently produces displacement of the trachea, larynx and esophagus than does the diffuse type of enlargement. Rose found that under the pressure exerted by goiters the cartilaginous rings of the trachea undergo degeneration as a result of which the trachea becomes soft and may collapse, causing sudden and fatal asphyxiation. Below the seat of obstruction the trachea is often dilated.

Aberrant Goiter —The thyroid is developed from a median pouch in the primitive pharynx, and in its migration between the third and eighth week of development it finally occupies its normal position in the neck, having traveled along what is later called the thyroglossal tract. Fragments of the developing thyroid or cells capable of developing into thyroid tissue may be deposited along this tract, and it is here that aberrant thyroids are more prone to develop. They occur also, however, in the mediastinum, in the pharynx, in the larynx, in the bronchi and in the esophagus as well as in the posterior triangles of the neck and the supraclavicular spaces. Normally, of course, these cell rests do not develop into thyroid tissue, but in the absence of the normal development of the thyroid gland there may be a compensatory enlargement of this aberrant thyroid tissue, so that not infrequently the aberrant thyroid is the only actively functioning tissue present, and its removal results in myxedema.

Although the thyroid gland in all stages of its development consists of a closed system of tubes and never empties into a duct, there is, nevertheless, a ductlike structure that forms along the thyroglossal tract

¹ Rienhoff, W. F., Jr. Diseases of the Thyroid Gland, in Practice of Surgery, Dear Lewis, editor, Hagerstown, Md., 1929.

It is spoken of as the thyroglossal duct. Remnants of this structure may be discovered anywhere from the foramen cecum down through the hyoid bone to the region of the thyroid gland. As a rule, such remnants are not more than 1 cm. long. They may be lined by squamous epithelium or by ciliated columnar epithelium and may have lateral outgrowths. Cysts develop at times from these embryologic remnants and may be present in the midline of the neck, immediately below the hyoid bone, as tense, inelastic, firm bodies. They may be suprahyoid. Occasionally, thyroid rests are associated with them, and in the absence of normal development of the thyroid these rests may give rise to functioning thyroid tissue or a real aberrant thyroid. Apparently, these thyroglossal cysts are rather troublesome structures for the surgeon, and their cure is said to necessitate a complete removal of the thyroglossal tract, usually including a portion of the hyoid bone.

The points of interest in the diagnosis of an aberrant goiter are the midline position of the tumor and the absence of a normal thyroid gland. The symptoms to which it gives rise are usually mechanical in nature and depend largely on the position of the tumor. Dyspnea and dysphagia are common symptoms. Unfortunately, the diagnosis is often not made until operation, and it is not always advisable that the tumor be disturbed unless it is giving rise to marked symptoms. In many cases the removal of the aberrant thyroid results in myxedema. The administration of small doses of iodine at several periods during the year may suffice in preventing the tumor from growing to an embarrassing size.

Exophthalmic Goiter—This type of goiter with its striking effect on the general metabolism, on the cardiovascular system and on the nervous system forms a dramatic clinical picture and will be rarely overlooked in a fully developed case. The symptoms that may develop in the otolaryngologist's particular sphere of activity include cough, subjective feelings of dyspnea, markedly irregular breathing and occasionally bronchitis. There may be, too, a feeling of fulness with throbbing in the ears, transient or occasionally persistent deafness, tinnitus or marked vertigo.

A feature of considerable controversial interest is the possible relationship of infections, including those in the nose and throat, to the onset of exophthalmic goiter. While it is generally considered now that there is an important underlying constitutional factor, the possible exciting causes of the disease range over a rather wide zone, among them focal infections are prominently championed. There are reports in the recent literature of the prompt subsidence of symptoms of the disease following the removal of infected tonsils and there are on the other hand, reports of the fulminant onset of the disease shortly after surgical procedures on the nose and throat. As a rule I advise a subtotal

thyroidectomy in all cases in which the disease is well marked, and later removal of infected tonsils and other possible sources of infection. In milder cases it may seem wise to remove the foci of infection first and to note the effect of the removal before advising an operation on the thyroid gland.

Symptoms of pressure may arise from the goiter in this disease just as from a simple goiter, particularly in cases of long duration that have shown many exacerbations and remissions.

Hypothyroidism—In cases of hypothyroidism the thyroid gland may be quite small, or, on the other hand, there may be a goiter. The clinical picture of hypothyroidism is less dramatic than that of hyperthyroidism and is apparently much more often overlooked. Publications from the Mayo Clinic indicate that most of their patients with hypothyroidism have not been recognized as having this condition before coming to the clinic.

There is characteristically a dryness of the mouth and a large tongue. In children the defective development of the bones of the face may result in narrow nasal passages. Snoring may be one of the early signs. There is often a chronic rhinitis, and a tendency to respiratory infection may be the feature that first brings the patient to the physician. Respirations are slow. Asthmatic attacks occur. There may be dulness of hearing and even marked deafness, the underlying basis of which is somewhat obscure. In some cases it is thought that a myxedematous condition of the mucous membranes of the ear may be present. Often it is more a psychic deafness than one due to any real structural changes in the organs of hearing.

In marked cases the myxedema involves the mucous membranes as well as the skin and may produce striking pictures in the nose, throat and larynx. In the recent literature there are a number of papers descriptive of such lesions in the larynx, pharynx and mouth. Mann² described the case of a woman, aged 25, who had been well except that in the past few years she had had frequent tonsillar abscesses. Six weeks after a tonsillectomy, dyspnea, pains in the neck and difficulty in swallowing developed. There were other complaints of headache, nausea, anorexia and cramplike pains in the heart. On examination there was found a marked pale edema of the entrance to the larynx, the epiglottis and the aryepiglottic folds, infiltration of the laryngeal cartilages and a purulent secretion. The vocal cords were said to be normal. The tongue was smooth, the soft palate very stiff and the uvula small and edematous. The epiglottis was much thickened, and its shape changed as if pressed together. The entrance into the larynx was much narrowed. The lingual tonsils appeared as thick, pale yellow,

² Mann. Seltene Kehlkopferkrankung mit eigentümlichem klinischen Verlauf, Ztschr. f. Hals-, Nasen- u. Ohrenh. **21** 369 (May 10) 1928.

laid tumors. The author further described the general symptoms of the marked hypothyroidism and reported that within two weeks after thyroid treatment was begun there was a marked subjective improvement, there was also marked objective improvement on examination of the upper air passages.

Adam³ reported three somewhat similar cases and stated that a so-called laryngitis that lasted for months and left the true cords practically unchanged in appearance was presumably myxedematous. He said that the back of the larynx looked like a beefy red shield, and that the pale, anemic appearance described in some textbooks was not apparent in his cases.

The diagnosis in hypothyroidism is most important. As I have indicated, the otolaryngologist may have the first opportunity to make it. The result of proper treatment by thyroid feeding is strikingly beneficial, without this proper treatment, improvement need not be expected or may be long delayed. As I have said, the diagnosis is often overlooked. Features that should lead the physician to suspect the possibility of hypothyroidism are

- (1) In children
 - (a) Retarded growth
 - (b) Habitual constipation
 - (c) Dulness at school
- (2) In adults
 - (a) Persistent constipation
 - (b) Endogenous obesity
 - (c) Dry, harsh skin
 - (d) Subjective feelings of cold
 - (e) Recurring drowsiness during the day

When any of these features are present, the basal metabolic rate should be determined and, if retarded, thyroid treatment should be instituted.

Cretinism—Endemic cretinism fortunately does not occur in this locality, but occasionally a sporadic cretin is observed. In goitrous districts endemic cretinism is, of course, important. Wherever endemic cretinism flourishes, endemic deaf-mutism is found, these conditions are considered to be the manifestations of the one disease cretinic degeneration. The ratio in Switzerland is said to be five cretins to four deaf-mutes. Apparently deaf-mutism may be practically the only evidence of the disease, or it may be associated with hypothyroid symptoms.

The pathogenesis of the deafness in these cases is a highly controversial point. A number of alterations in the peripheral hearing

3. Adam, I. Laryngeal Myxedema, Brit. M. J. 1: 594 (April 7) 1928.

apparatus have been described incomplete ossification of the stapes, defective development of the epithelial cells of the cochlea, anomalies of the malleus and myxedematous thickening of the tympanic mucous membrane Other students of the condition ascribe the greatest importance to the degeneration in the cortical centers, or rather, perhaps, to the developmental defects in these centers

Effect on the Recurrent Laryngeal Nerves—In persons with goiters the laryngeal disturbance due to partial or complete paralysis of the recurrent laryngeal nerve¹ may result from

- (1) Direct pressure of the goiter on the recurrent nerve
- (2) Injury during operation—
 - (a) Direct trauma by clamping, cutting or ligating the nerve
 - (b) Indirect trauma by stretching and pulling on the nerve in manipulation of the gland
- (3) Postoperative hemorrhage or oozing causing pressure on the nerve
- (4) Inflammation or scar tissue formation after an operation involving the nerve

Since the symptoms are not always indicative of the state of the muscles controlling the vocal cords, surgeons who perform operations on the thyroid gland are usually careful to have routine laryngologic examinations made both before and after operative procedures

Following their experimental work, Judd, New and Mann⁴ concluded

1 Section of the recurrent laryngeal nerve produces complete paralysis of the vocal cord of the corresponding side, which in all probability will be permanent

2 Ligation of the recurrent laryngeal nerve with linen, chromic catgut or plain catgut produces complete and probably permanent paralysis of the vocal cord of the corresponding side

3 Stretching the recurrent nerves acutely in a manner that is similar but of longer duration and intensity than that in operation does not impair the function of the vocal cord

4 Stretching the recurrent laryngeal nerves for a long period, as over muscles, impairs the function of the vocal cords, but the impairment is probably due to the operative trauma and not to the stretching

5 Pinching the recurrent laryngeal nerves with a hemostat in a manner similar to that which may occur in an operation produces temporary paralysis of the vocal cords Restoration of function always occurs, the length of time necessary for restoration depending on the anatomic point at which the nerve is crushed The time found necessary for complete regeneration of the nerve, when injured in the area usually traumatized by operation, is between thirty and sixty days

6 Exploration of the recurrent laryngeal nerve produces an effect on the vocal cords, depending on the amount of trauma to which the nerves are subjected Careful dissection will probably not produce any effect

4 Judd, New and Mann, quoted by McNerthney, J B Laryngeal Paralysis and Thyroid Surgery, Northwest Med **27** 326 (July) 1928

Indirect Relationships—Certain indirect relationships may be of some interest to the otolaryngologist

Within the past year Owen Cope and Hill⁵ called attention to an unsatisfactory test of the basal metabolic rate that they considered the result of perforated ear drums. While it was not proved beyond a doubt they thought the evidence very suggestive. In their case several unsatisfactory tests indicated leakage, but no other source of leakage was found except the perforated drum. The reading had shown minus 36 per cent. They stopped up the ears and other readings were quite satisfactory. The rate was found to be normal. Their tracings showed breaks suggestive of the time of swallowing movements. One might well be on the lookout for such instances and see whether their observations can be confirmed.

A few months ago there appeared a report by Kilduffe⁶ of necrosis of the larynx as a possible complication of the treatment of goiter by irradiation. In his case the irradiation had occurred five years before and with good effect on the exophthalmic goiter. The patient a woman aged 32 appeared for treatment on Sept. 16, 1927, for some minor ailment. The hemoglobin was 85 per cent, the white blood cells 14,000, and the polymorphonuclear leukocytes 73 per cent. Two months later, on November 17, the patient came again, complaining of headaches, and soreness of the neck and throat. The temperature was 101 F. The next day there were hoarseness and difficulty in swallowing. She was prostrated and toxic. No diphtheria or Vincent's organisms were found. The white blood cells were 1100 and the polymorphonuclear neutrophils 40 per cent. A laryngologist in consultation found no lesion. The next day another laryngologist found gangrene of the arytenoid cartilages. The patient died and an autopsy was held one hour after death. The thyroid was found to be shrunken. The larynx showed gangrene of the cords and adjacent tissues and of the contiguous portion of the base of the tongue. The odor was quite foul. There was a mixed bacterial flora. The author stated his belief that the irradiation was at least a contributory factor. He cited Clerf's report of a similar case occurring five years after roentgen treatment and another occurring nine years after such treatment. Iglauder reported a case and collected twenty others and Clerf added six more to the literature.

PARATHYROID GLANDS

When the parathyroid glands are completely removed there occurs a condition spoken of as tetany—tetania parathyreopriva—in which

⁵ Owen, Cope and Hill. Unsatisfactory Test of Basal Metabolic Rate as Result of Perforated Ear Drum. J. A. M. A. 90 1442 (May 5) 1928.

⁶ Kilduffe R. A. Necrosis of Larynx as Possible Complication of Treatment of Goitre by Irradiation. Arch. Otolaryng. 8.185 (Aug.) 1928.

there are hyperexcitability of the motor nerves, with a tendency to develop certain hyperkinetic phenomena, disturbances of the sensory nerves, with paresthesias, etc., certain metabolic disorders, notably diminution in the calcium of the blood, changes in the intermediary protein metabolism and changes in the acid base equilibrium of the body

Besides the tetania parathyreopriva, there are other clinical types of tetany, for example, that occurring in children often in association with rickets, tetany accompanying certain diseases of the digestive apparatus—so-called tetania gastrica or tetania colonica—tetany occurring during pregnancy—tetania gravidarum—and the so-called tetania idiopathica of workmen in certain trades in central Europe. By analogy with the tetany following the removal of the parathyroid glands there has grown up the doctrine of unity in the conception of tetany attributing all types of cases to the abolition of or to an insufficiency of the function of the parathyroids. This idea, however, is not by any means universally accepted.

While the carpopedal spasms are especially characteristic, the spasmodic phenomena may involve a great many of the muscular structures of the body. Laryngeal spasm is one of the common symptoms of tetany in childhood and may be the only spontaneous chronic spasm exhibited. As many of these children have rickets, there is often a dispute as to whether the laryngeal spasm is due to rickets, to tetany or, perhaps, to some organic disease of the nervous system. The diagnosis of tetany may be made by the demonstration of an increased electrical excitability of the motor nerves or may be aided by demonstrating a positive Chvostek sign, contraction of the facial muscles following tapping on the facial nerve, or a positive Trousseau sign, the production of a carpal spasm by maintaining pressure on the upper arm for several minutes. The pressure should just exceed that sufficient to obliterate the pulse.

HYPOPHYSIS CEREBRI

The hypophysis, in its sella turcica, is in close physical association with the sphenoidal sinus. The nasosphenoidal route has been used in the surgical approach to the sella and to the hypophysis. Occasionally a hypophyseal tumor erodes the floor of the sella and extends into the sphenoidal sinus.

The hypophysis is a complex structure with an anterior epithelial portion and a posterior nervous portion. The anterior lobe is developed from an ectodermal pouch, called the pouch of Rathke, which grows upward under the brain from the stomodeal epithelium. In later development, Rathke's pouch is divided into different portions, and from the cranial part there are developed the pars anterior propria, the pars inter-

media and the pars tuberalis. There are sometimes small accessory hypophyses which are also situated in the sella turcica. From the pharyngeal portion of Rathke's pouch there develops the so-called hypophysis pharyngea, situated in the middle line near the junction of the nasal septum and the roof of the pharynx, in the adult, it measures about 5 by 1 mm. The tissue presents all the histologic features of the anterior lobe of the hypophysis. According to Lewis, it is to be regarded as an actively functioning gland rather than as a rudimentary or involuting one. Tumors analogous to the aberrant thyroid glands have been described. Eidheim found one in the sphenoidal sinus in a patient who had acromegaly. The hypophysis was in its usual position in the sella turcica and was normal in appearance. A few tumors have been found in the roof of the pharynx, having a histologic picture similar to that of the anterior lobe of the hypophysis.

Acromegaly—An important function of the anterior lobe of the hypophysis is a stimulating effect on growth. This is shown in the outstanding disease of this portion, acromegaly, and also by the experiments of Evans⁷ and his co-workers who were able to produce gigantism in rats by injecting sterile protein-free extract of the anterior lobe. Hyperplasia or adenomas of the chromophil cells of the anterior lobe are associated with acromegaly. Adenomas of the chromophobe cells, on the other hand, do not produce acromegaly but show merely the signs and symptoms of hypophyseal tumor, together perhaps with some of the features that suggest a lack of secretion of the hypophysis. It is from the posterior lobe, derived from the nervous system and from the thin intermediary portion, that the active principle (pituin, hypophysin, pituitary liquid) used as a pharmaceutical agent is derived.

Acromegaly, an interesting disease, is fortunately rare. It is chronic, usually beginning in the third decade and characterized by a marked bony overgrowth involving the facial portion of the skull, the hands, the feet and all the bones in the body. There is an associated hypertrophy of the soft parts, with marked coarseness of the features to the point of deformity. Later in the disease there are hypertrophy of the internal organs, signs and symptoms of the pituitary tumor, asthenia, paresthesia, often severe pain, and frequently a widespread disturbance of the other endocrine glands. Goiters, with their possible effects of pressure, are not unusual.

Among the early symptoms are headaches, pain in the face and paresthesias in the head and face. Mark,⁸ who wrote an autobiography

⁷ Evans, H. M. The Function of the Anterior Hypophysis, in Harvey Lectures, Philadelphia, J. B. Lippincott Company, 1923-1924, p. 212.

⁸ Mark, Leonard P. Acromegaly. A Personal Experience, London Balliere, Tindall & Cox, 1912, p. 160.

of a patient with acromegaly, described the sensation as if the face were in a vise, the antium tightly packed, the teeth too large for their sockets and the eyes pressed on

Chevalier Jackson⁹ gave a description of the laryngoscopic appearance in four patients with acromegaly, one of whom required a tracheotomy for laryngeal stenosis. He said

External palpation of the larynx revealed it to be of enormous size, the enlargement seeming even and symmetrical. Laryngoscopic examination showed a general overgrowth of the larynx. The epiglottis, aryepiglottic folds, ventricular bands and vocal cords were proportionately enlarged. An appearance of asymmetry was given by the deviation of the long axis of the glottis which instead of being sagittal was deviated to the left posteriorly. The glottic chink was very narrow and was insufficient for breathing. The left aryepiglottic fold was as much thickened as the right but was not so long. The whole laryngeal image was strongly suggestive of the facies and ginger-bread hands of acromegaly.

This was the description of the case that required a tracheotomy. The changes in the other cases were similar.

The tonsils are often greatly enlarged in acromegaly and there may be excessive lymphoid tissue in the pharynx. The frontal sinuses are deep, and there may be enlargement of the antiaurals. Curchod¹⁰ recently reported a case of a patient with mild acromegaly who complained of nasal obstruction. There was marked hypertrophy of the turbinates and a diffuse edematous infiltration of the nasal mucosa that on histologic examination showed inflammatory elements with edema and here and there a hyperplastic angiomatous proliferation.

In regard to the pharyngeal hypophysis, Beck¹¹ quoted Bryant as believing that chronic nasopharyngeal infections interfere with the pharyngeal pituitary function and that removal of the tonsils and adenoids, with relief from the infection, results in more rapid growth and improved nutrition.

STATUS LYMPHATICUS AND THE THYMUS

The recent review of this subject by Marine¹² in the *Archives of Pathology* will prove interesting, I am sure. I agree with him entirely in relegating the thymus, formerly given a central rôle in this picture,

9 Jackson, C. Acromegaly of the Larynx, J. A. M. A. **71** 1787 (Nov. 30) 1918.

10 Curchod, E. De quelques alterations morphologiques rhinopharyngees en relation avec le syndrome hypophysaire, Schweiz. med. Wchnschr. **58** 537 (Mar. 26) 1928.

11 Beck, Harvey G. Dystrophia Adiposogenitalis, in Endocrinology and Metabolism, Barker, Hoskins and Mosenthal, editors, New York, D. Appleton & Company, 1922, p. 858.

12 Marine, D. Status Lymphaticus, Arch. Path. **5** 661 (April) 1928.

into a decidedly secondary place. The function of the thymus is unknown but it resembles the lymphoid tissues closely. There is no proof that it has an internal secretion. Marine's definition is as follows:

Status lymphaticus may be defined as a constitutional defect usually congenital, though it may be acquired, dependent on an inadequacy of some function of the suprarenals, sex glands and autonomic nervous system and associated with lowered resistance or increased susceptibility to a great variety of nonspecific physical and chemical agents. Anatomically it is characterized by delayed involution or hyperplasia of the thymus, hypertrophy and hyperplasia of the lymph glands and lymphoid tissue of various organs, underdevelopment of the chromaffin, gonadal (suprarenal cortex, interstitial cells of testes and ovaries) and cardiovascular systems and certain peculiarities of external configuration.

The otolaryngologist's interest in this connection is chiefly in the so-called thymic asthma and in the peculiarly lowered resistance of these patients with the greatly increased risk that the surgeon assumes when operating on them.

Unfortunately, there are no satisfactory criteria for the clinical recognition of such cases, especially in young children. The usual signs of a pale, thin, velvety skin, enlargement of the tonsils, superficial lymph glands and thymus, and lymphocytosis are not constant occurrences. Enlargement of the lymphoid follicles at the base of the tongue is said to be a constant sign in cases of status lymphaticus, though it may be present in other conditions. When the lingual follicles are enlarged, it would be wise to make a careful search for other signs.

The controversy concerning the cause of death in status lymphaticus and concerning the respiratory stridor also has been going on for many years. Marine cited the following theories: 1. Death is due to pressure of an enlarged thymus on the trachea, blood vessels and nerve trunk. 2. It is the result of the constitutional defect manifesting itself through an injurious raising of the vagus tone together with a deficiency of the chromaffin system and weakness of the sympathetic system. 3. It is a result of hypersusceptibility to physical and chemical agents. 4. It occurs through anaphylaxis. 5. It results from an abnormal thymus secretion of a general lymphotoxemia.

It seems to be acknowledged that occasionally tracheostenosis may be produced by an enlarged thymus as reported by Jackson and others in bronchoscopic examinations, but in the great majority of cases no evidence of pressure is found. The relief experienced from roentgen treatment is not necessarily proof of a thymic origin because (1) the relief is sometimes too rapid, and (2) the benefit may be due to other and more distant effects of the roentgen rays. Another important bit of evidence against a thymic stridor or asthma is that the stridor may be present when the thymus is small, or absent when the thymus is large.

SUPRARENAL GLANDS

The suprairenal bodies are, like the hypophysis, divisible into two portions, different in structure, in embryologic development and in physiology. The cortical portion or the so-called interrenal tissue is closely related to the gonads, while the medullary portion is closely connected with the sympathetic nervous system. It is from the medulla of the suprairenals that the active pharmacologic preparations are obtained. However important epinephrine may be to the otolaryngologist, it is evident from experimental work that the medullary portion of the suprairenals is not necessary to life. The removal of the cortex, on the other hand, is fatal.

The outstanding clinical syndrome associated with the suprairenal glands is Addison's disease, regarded as a result of a lesion of the gland as a whole. It is a chronic, progressive and fatal disease that is fortunately not common. Its chief features are marked asthenia, bronzing of the skin and mucous membranes, gastro-intestinal disturbances, very low blood pressure and perhaps a general vascular hypoplasia. The spleen is often enlarged, and the lymphatic structures are generally enlarged. There is usually anemia of the secondary type and lymphocytosis.

As already pointed out, there is a certain relationship between hypoplasia of the chromaffin tissues and status lymphaticus. It is now generally believed that a tuberculous or other lesion of the suprairenal glands that produces Addison's disease is prone to develop only in defective structures such as might be associated with status lymphaticus.

The chief interest of the otolaryngologist in Addison's disease lies in the pigmentation of the mucous membranes and in the features already pointed out for status lymphaticus.

Pigmentation of the mucous membranes that is almost constantly present is usually distributed in the form of small, bluish-black spots or streaks on the lips near the mucocutaneous junction, the border of the tongue, the buccal mucosa, the gums and the soft palate.

Patients with Addison's disease, as in status lymphaticus, show the peculiar lack of resistance or increased susceptibility to external agents that makes them poor surgical risks.

Lesions of the interrenal tissues or cortical portion of the suprairenal glands usually give rise to disturbances in the sexual sphere and, while interesting in themselves, are of no especial interest to the otolaryngologist.

GONADS

Here I refer to the partly fanciful, partly real association of the nasal mucosa with the gonads. In 1893, Fliess described a form of dysmenorrhea which he spoke of as nasal dysmenorrhea. Since then,

there have been many reports, but, as Novak¹³ stated, the subject has not been investigated with the thoroughness or finality to which its interest and importance would seem to entitle it.

It is known that erectile tissue is found in the nose as in the genital tract. In the nose it is found especially at the anterior end of the inferior turbinate bone and in a small circumscribed area known as the tuberculum of the nose. These are the two areas that Fliess designated as the genital spots. According to Fliess, these spots are always swollen and congested during menstruation. Fliess believed that by his test of the application of 20 per cent solution of cocaine to the genital spots of the nose, he could decide whether or not further nasal treatment would relieve the dysmenorrhea. The treatment was given by applying the cocaine four different times at intervals during the menstrual cycle. After this test had proved positive, trichloroacetic acid was sometimes substituted for the cocaine.

Another author, Schiff, convinced himself further that the application of cocaine to the anterior end of the inferior turbinate caused the disappearance of pain in the hypochondrium, while a similar application to the tuberculum of the septum controlled the backache. Other authors who could confirm in a measure the beneficial results of such treatment emphasized the need of caution in interpreting these results and are inclined to stress the psychic factors as well as the general effect of the cocaine after absorption into the circulation. I would refer those who are particularly interested in this subject to Novak's monograph on "Menstruation and Its Disorders."

Another matter of controversial interest is the subject of vicarious menstruation. Certain important authorities would deny that there is such a phenomenon. Others deplore the fact that it has in the past been so strongly emphasized. Novak states that authentic reports of vicarious menstruation are now so numerous that there can be no question as to its occurrence. It must still, however, be regarded as an uncommon phenomenon. Epistaxis seems to be the most frequent form taken by the vicarious menstrual bleeding. A hemorrhage from the nose may be slight or profuse and may continue intermittently throughout the normal menstrual period. Bleeding from almost all parts of the body have been listed under this heading. There is a recent report¹⁴ in the literature of a young woman with pulmonary tuberculosis who had a brisk hemoptysis during the menstrual period for seven successive periods, and showed absolutely no blood in the sputum at any other time in the menstrual cycle. The diagnosis of vicarious menstrual

¹³ Novak, Emil. *Menstruation and Its Disorders*, New York, D. Appleton & Company, 1921.

¹⁴ Chapman, R. S. Unusual Type of Vicarious Menstruation, *Brit. M. J.* 1 1065 (June 23) 1928.

bleeding should never be made, of course, unless it is satisfactorily demonstrated that the bleeding occurs at the time of menstruation during a number of menstrual periods and at no other time

PANCREAS

I wish to point out here the reciprocal relationship existing between infections in general and the glandular disorder responsible for the development of diabetes

Although it is not certain that focal infections or acute infectious processes are important exciting causes of diabetes one does feel sure that diabetes is made worse by such infections. Hence the internist has the greatest interest in having focal infections in his patients treated with great care and eradicated as far as possible.

Conversely, the otolaryngologist not infrequently needs the services of the internist in treating such patients. Infections in the nose and throat, as well as otitis media and mastoiditis, may cause a great deal of trouble in patients with diabetes and then may heal promptly with the institution of the proper dietetic regimen and the correct use of insulin.

OTOSCLEROSIS

In almost all of the special fields of medicine there are certain conditions the etiology of which is obscure and about which many opinions are expressed. In such discussions the endocrine glands as might be expected, often play an important part. I take it that in otolaryngology otosclerosis would fill this rôle acceptably.

Various authors have noted the features suggestive of an endocrine disturbance in otosclerosis. They have pointed out the hereditary tendency that it occurs especially in females and that it is apt to be worse at the stages of puberty, pregnancy and the climacteric. They have cited the vasomotor signs and symptoms in combination in some cases with blue sclerae, fragility of the bones and diminished calcium in the blood. The basal metabolic rate, in the opinion of some observers, is usually reduced, in the opinion of others it is usually accelerated. The hypophysis, the thyroid, the gonads and other glands are incriminated by different students of the disease. Montgomery,¹⁵ in a recent review quoted Diury to the effect that in one third of the cases there is no evidence of an endocrinopathy, but that various endocrinopathies occur in two thirds of the cases. He believes that the endocrine disturbances might be a factor in the development of otosclerosis, but that underlying them there must be the diathesis toward its development.

¹⁵ Montgomery, R. R. *Otosclerosis. Review of Literature*, Arch. Otolaryng. 7:321 (April) 1928.

It would seem to me that there are many analogies to this situation in other fields of medicine, that the probable explanation of otosclerosis lies in a congenital inferiority of the auditory apparatus, that frequently there is associated with it a congenital inferiority of the endocrine system, and that there is no necessity or justification for assigning to the endocrinopathy an etiologic rôle in the development of the otosclerosis

DEAFNESS AND COINCIDENT VARIATIONS IN NASAL AND IN AURAL PATHOLOGY *

EDMUND PRINCE FOWLER, M D

NEW YORK

In health and in disease, acuity of hearing may vary from time to time, even from hour to hour, up and down, depending on factors many of which are unknown, but clinical experience warrants the conclusion that marked variations in the degree of deafness are fundamental signs of a changing condition in the ear, and they have been so interpreted in this study, irrespective of the otoscopic picture. The majority of diseases of the ear, like the majority of most diseases, are self-limited processes which tend to resolution and restoration of function. There are, however, many lesions which from their incipency seem chronic. Though medical science has found few cures for these, it must constantly strive to solve the mysteries of their being. A considerable number of apparently chronic inflammations are associated with disease in other parts of the organism, contiguous or remote. Such are chronic disease of the organs of special sense, preeminently of the ear.

In searching for the causes of deafness, it is apparent, then, that attention should be directed to many tissues outside of the ear, and that though the disease of the ear may be directly responsible for the complications and deafness, both of these may ultimately prove to be primarily dependent on lesions located at some distance from the ear. For instance, such conditions as focal infections, disease in the nose, throat, chest and abdominal organs, and metabolic dyscrasias, etc may be the cause of disease of the ear. On the other hand, furuncles, exostoses, nerve degeneration, and inflammations of the mastoid cells and contiguous structures, though directly caused by a disease of the ear, may be dependent primarily on lesions that had set up the prior inflammation in the ear.

Diseases of the ear frequently occur coincidentally with nasal inflammations, and yet commonly they appear to occur independently of nasal disease. The thought occurred that the reason no nasal disease was discernible in many instances was that it had not been properly looked for, for several years, therefore, a search has been made, not only with the naked eye, but with the aid of special technic and stereoscopic roentgenology.

* Submitted for publication, Aug. 30, 1929

A year ago, before the American Laryngological, Rhinological and Otological Society, there were reported the observations in 100 consecutive cases of disease of the ear in children. 86 per cent of these patients showed definite disease of the sinus, and all showed some symptoms of sinus disease. Depending on the group, the disease, as shown by x-rays, varied to such an extent that it was thought advisable to continue these studies until a sufficient number of cases were tabulated to establish the conclusions more definitely. During the past year, about 300 cases have been observed, and it may be stated that in general the results correspond with those obtained last year. Further particulars will be published later regarding these observations.

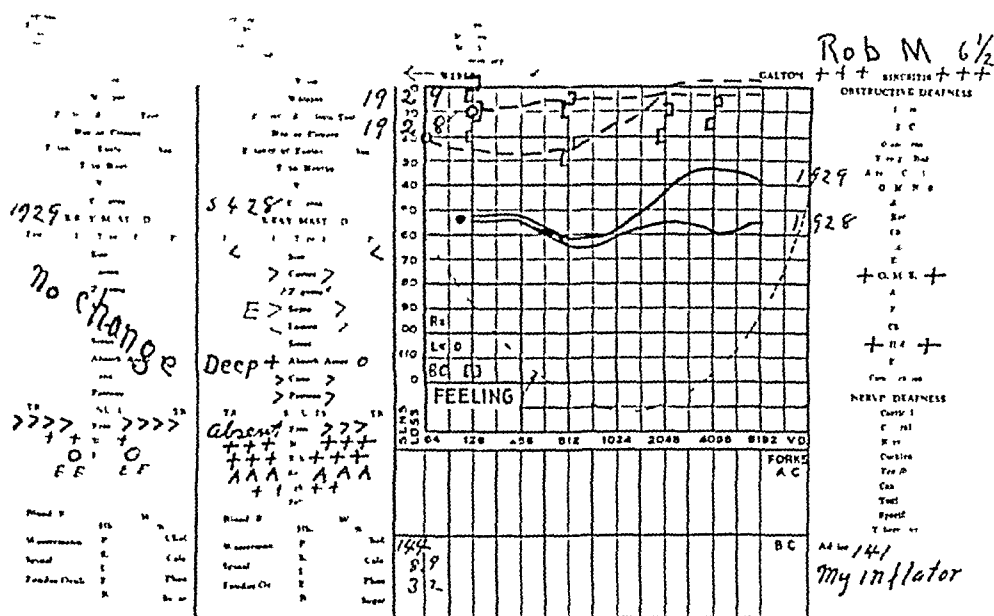
At this time, a report will be made on the variations found in nasal and aural disease coincident with variations in hearing. It is possible to do this because the scheme devised last year was carried out. This was to make repeatedly complete clinical, otoscopic, audiometric and roentgen examinations. It has been held that there is no use in treating the chronically deafened patient (once deafened, always deafened). For the adult there is much truth in this, but for the child there is much error, because careful measurements have shown marked improvement in 25 per cent of the present series of deafened children, and definite improvement in 50 per cent. This is a low estimate, because patients often fail to return for retesting.

All cases of deafness were placed in four age groups: from 1 to 9, from 10 to 15, from 16 to 21, inclusively, and over 21 years. When the data on several hundred cases in each disease group have been collected and compared with data on a large number of persons with normal hearing, it is hoped that information of value will be obtained from this method.

What is chronic deafness? How long must one be deafened before the condition may be called chronic? The children and most of the adults observed had chronic deafness in the accepted definition of the term, that is, they had been deafened for several years, and no likelihood of improvement or cure seemed probable. Of the patients who showed improvement, some maintained this improvement and some did not. From both classes much was learned concerning the cause of the deafness, because the patients were examined soon after an improvement in hearing and soon after a relapse, and following both conditions the changes in aural and sinus disease were noted. In some instances, no change was detected, but in this case there had usually been a delay of a few weeks between the change in hearing and the taking of the films. This delay was sufficient to permit recurrence of or recovery from the sinus disease and the inflammation in the ear. In other words, the condition changed between the test for hearing and the presentation of the patient for roentgen examination.

One cannot catch every change in the disease picture unless the patient is constantly under observation. However, if with definite changes in the function and the picture of a diseased organ, there occur repeatedly coincident changes in the function and the picture of a closely related organ, little doubt remains but that the diseases in the two organs are correlated. The important thing is to be certain that the observations as to function and picture are accurate. Careful audiometric examination establishes accuracy of the functional state. Careful clinical examination and stereoscopic roentgenograms interpreted by an expert establishes accuracy of the disease picture.

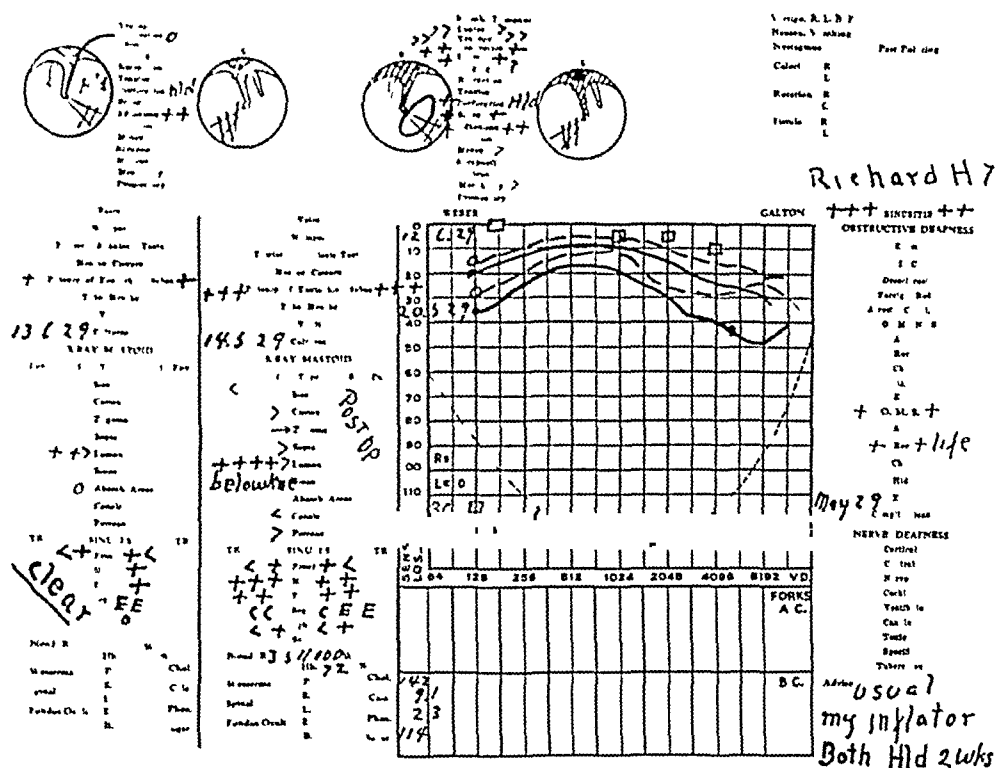
The ethmoid cells were selected for careful study, because it was noted that although the nasal sinus spaces might show no involvement,



absorption. In other words, the picture in extreme absorption is similar to that obtained after complete operative evisceration of the ethmoid labyrinth. Exudates within the cells may obscure or mask the cell walls and give a false picture of their absorption. In such cases, the walls reappear with the subsidence of the edema.

By condensing osteitis (*Co*) is meant a shrinking of the septums, a terminal stage of inflammation of the bone, wherein the shadow of the bony wall is thinned and intensified because of the relatively larger proportion of lime salts. This stage may go on to a sclerosis.

By edema is meant a swelling of the bone. This occurs in early stages of osteitis and in circulatory stasis. In the roentgenograms, the



A sufficient number of charts are shown to establish the conviction not only that the deafness and its variations were intimately associated with the coincident variations in sinus disease, but that the aural disease which produced the deafness was primarily caused by the disease in the nasal spaces (Treatment based on this conviction has added the proof of clinical results)

As a cause of deafness and of variations in hearing, nasal sinus disease has not received adequate attention To combat deafness successfully, one must also successfully combat disease in the nose and nasal sinuses

CONCLUSIONS

1 Stereoscopic roentgenograms, properly taken and interpreted, furnish data for the better diagnosis of and changes in sinus disease

2 Eighty-six per cent of the diseases of the ear are associated with diseases of the nasal sinuses

3 The proportion varies greatly in different age and disease groups

4 Marked variations in the degree of deafness are fundamental signs of a changing pathologic condition of the ear

5 Changes in the aural disease were regularly accompanied by changes in the nasal disease

6 The absence of changes in the disease of the nasal sinuses as shown by x-rays does not mean change may not have occurred previously

7 Unless the roentgenograms and the audiograms are taken on the same day, the variations may be found not to coincide

8 Coincidental variations occurred so constantly that it is believed that the nasal disease was the fundamental factor in the variations in hearing, and in the etiology of and the changing disease in the ear

114 East Fifty-Fourth Street

Clinical Notes

A NEW INSTRUMENT FOR THE CONTROL OF TONSILLAR HEMORRHAGE

IRWIN I ALPFR, M D, NEW YORK

This 'compressorium' was invented by Dr Waldapfel of the Hajek Clinic, Vienna. Its aim is to produce adequate, constant pressure over either one or both tonsillar areas in toto, or on any direct bleeding spot in a tonsillar fossa, depending on the conditions present. It has the special attributes of being retained without any discomfort even by a child, and of exerting sufficient styptic pressure over a local bleeding point or the whole tonsillar fossa on both sides at the same time, and yet it is not so rigid as to be uncomfortable when the patient attempts to swallow. It has a joint in it which permits it to move with the act of deglutition without disturbing its position or diminishing its constant pressure.

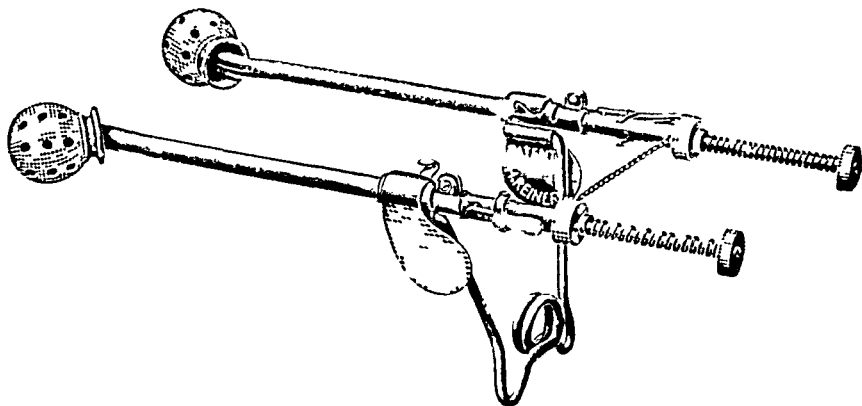


Fig 1—Instrument described in text

in the proper direction. This movement without partial loss of function prevents decubitus, which sometimes occurs with the more rigid types of hemostats.

As the photograph of the instrument shows, it is composed of two round perforated knobs which end at their proximal extremity in a collar-like ridge, which has a rubber ring in it. Gauze tampons can be fitted around the knobs using as many as is necessary, depending on how large a fossa one wishes to compress. The tampons are fixed to the knobs by means of the elastic ring around the groove mentioned. Each knob is attached to a metal tube about 0.5 cm in diameter and about 10 cm in length. These tubes end in their proximal extremities in a round metallic disk by means of which one can turn the knobs, even after they are in the tonsillar fossae, in any direction so as to concentrate the pressure at the bleeding points, if desired. By pushing on these plates the knobs are advanced any desired distance. This position is maintained by a notched catch on the metal arms of the instrument. Slight pressure on this catch will release it from its notch, and the arms and knobs will spring back automatically to their original positions.

* Submitted for publication Sept 3, 1929

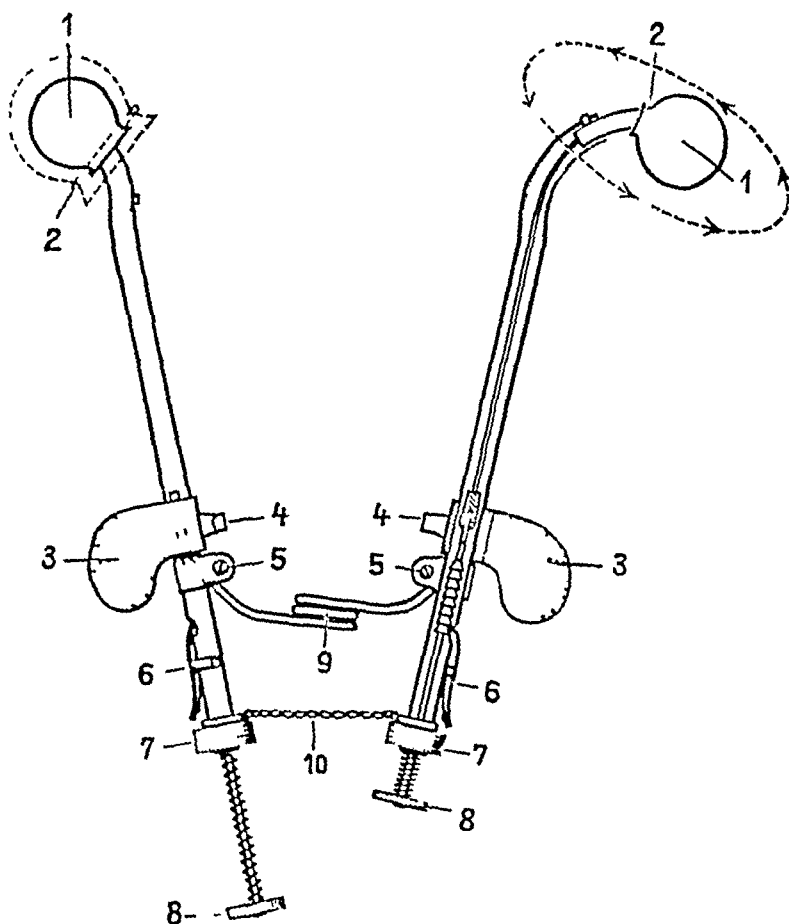


Fig 2—Diagram showing various parts of instrument 1 indicates perforated round terminals, 2 rubber collars (to maintain gauze in position, 3, fingerplates to approximate the arms of the instrument, 4, fingerplate screw, 5, terminal for spring, 6 catch to maintain arms at various lengths, 7, device for rotating arms into desired angle, 8 pressure knobs to advance the arms of instrument 9 spring separating arms, and 10 chain to prevent labial stretching

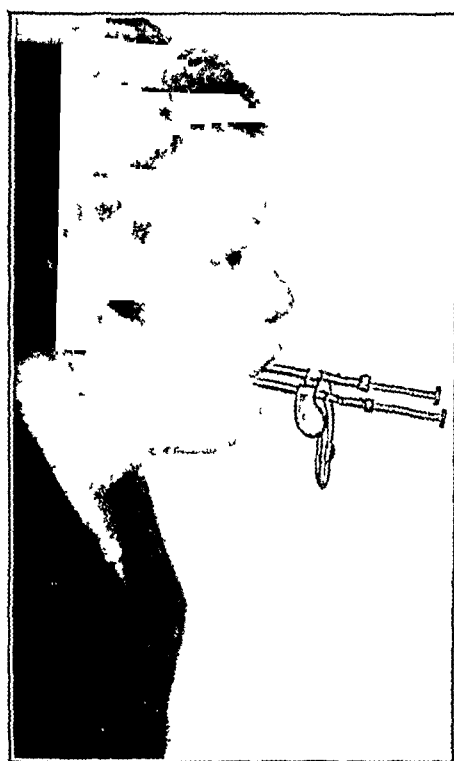


Fig 3—Instrument in place

At the proximal end of each arm is a circular wire spring which exerts its pressure inward. Connecting both arms is a twisted piece of metal in the form of a clasp spring. This tends constantly to separate the arms. Thus the resultant of both forces gives a constant pressure backward (toward the pharyngeal wall) and outward against the tonsillar fossa. This is the most advantageous direction of the pressure to stop bleeding.



Fig 4—Hemorrhage on the left side with packing mainly backward and outward. Photograph was taken with barium infiltrated gauze on the left side.



Fig 5—Hemorrhage on the left side with packing on all sides.

The utilization of this instrument is simple. First the source of the bleeding is located by sponging. A gauze sponge is then fixed around each knob and is fastened into the groove with the elastic ring. The instrument is grasped between the thumb and the forefinger and is compressed so that the knobs are approximated. It is then inserted into the mouth and released slowly so that a knob rests in each tonsillar fossa. Now the knobs can be turned or the rods can be

lengthened or shortened to fit each individual case and also to concentrate the pressure directly against the bleeding spot. The knob on the nonbleeding side may be turned so as to exert a pressure directly opposite to the knob in the bleeding side, thereby increasing the pressure on the bleeding side.



Fig 6—Hemorrhage on the left side with packing mainly backward and outward



Fig 7—Hemorrhage on the left side with packing mainly forward and outward

In cases with large tonsillar fossae the tonsillar beds are filled with gauze tampons as for ordinary digital compression. The instrument is then inserted as mentioned previously, on top of the gauze tampons. The distribution of the pressure in the packed bed is fairly well equalized, so that it is not necessary to change the direction of the knobs in most cases. If, however, the bleeding is

from an extreme point in the tonsillar bed, the packing is localized over this point, and the knob is applied directly over the tampon

The instrument can be left in situ until all fear of hemorrhage is gone. Thus, whereas in some favorable cases from one to two hours were sufficient to arrest the bleeding, in other extreme cases the instrument was left in from twelve to eighteen hours without any untoward effects or discomfort and with absolute control of bleeding. I have used this instrument and have seen it used at the Hajek Clinic both as a prophylactic—to prevent bleeding in cases in which the patients were suspected of bleeding, and after postoperative bleeding, with uniform success and without recourse to other more radical methods.

The advantages of this instrument over other methods are

1 There is a self-retaining elastic system which accommodates itself to the movements of the pharynx, and keeps the bleeding points under constant and equal pressure

2 The direction of the pressure can be modified as desired to fit the individual case

3 The knobs remain fixed automatically on each required point

4 The same instrument can be used on all patients—children or adults—without the addition of extra knobs. It is always ready for use

5 The instrument can be used prophylactically in cases without bleeding instead of digital pressure

6 There is a minimum of discomfort to the patient with this instrument. The patient can even take nourishment with this instrument in situ

7 No extra suturing or traumatizing of tissue is necessary

8 The instrument combines facility of application with certainty of result

A NEW APPARATUS FOR ROENTGENOGRAPHY OF THE SINUSES

HARRY L. BAUM, M.D., DENVER

The apparatus presented herewith has been devised for the purpose of facilitating roentgenography of the sinuses, particularly when the horizontal ray is to be utilized. It is of special advantage to use an apparatus that will permit roentgenograms of the head to be taken with the patient in the sitting position, regardless of whether or not it is thought necessary to use the horizontal ray. This advantage is greatly increased when the latter technic is adhered to. It is my belief that the use of the horizontal ray in roentgenography of the sinuses is at all times desirable, but especially so in those cases in which filling with a contrast medium is employed. Thus, the fluid level is clearly defined, and by changing the position of the head it is possible virtually to reconstruct the cavity to be studied by means of exposures made in the three planes—postero-anterior, lateral and vertical.

This apparatus facilitates the application of these principles and also has an added advantage which I have found of great importance—it enables the operator to center the ray on the film easily and accurately.

* Submitted for publication, Sept. 26, 1929

* Read before the meeting of the Midwestern Section of the American Laryngological, Rhinological and Otological Society, Denver, Jan. 12, 1929

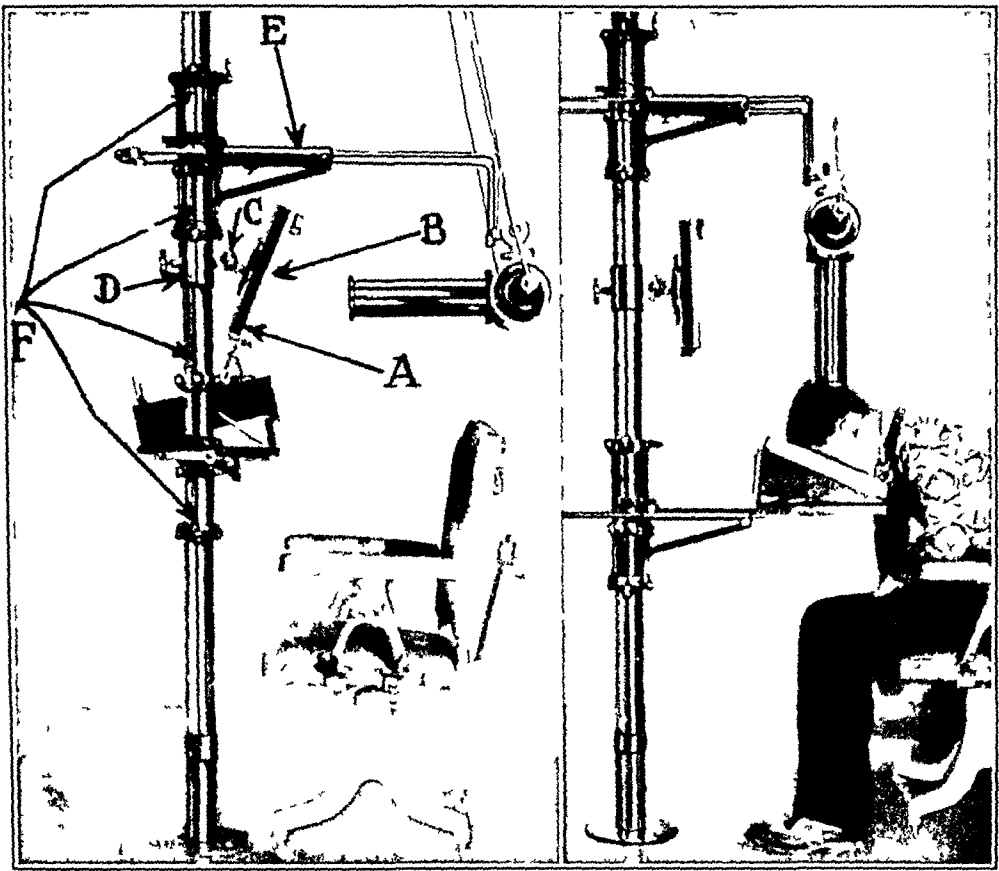


Fig 1—In the illustration on the left, *A* indicates the cassette holder, *B*, the bachelite panel with nasal aperture, *C*, tilting arrangement (permits adjustment to any desired angle), *D*, sliding collar for raising and lowering cassette holder, *E*, tube carrier, and *F*, marking on tube stand, cassette holder and tube holder for lining up to center ray on film. The illustration on the right shows the use of the adjustable shelf for making exposure with vertical ray (Granger sinus board)

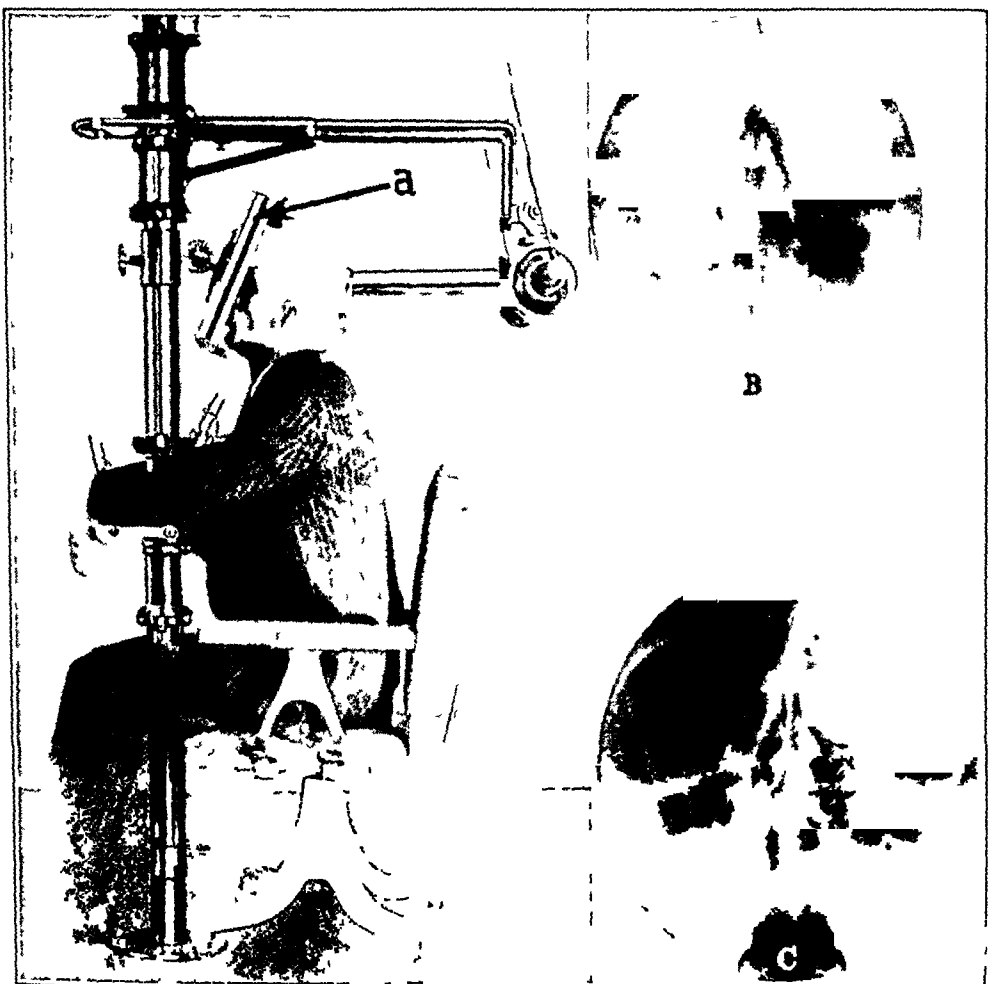


Fig 2—*A*, postero-anterior position, 23 degree angle (*a*, cassette in position) *B*, postero-anterior film *C*, postero-anterior film, partial filling. Note fluid level of iodized oil

It consists (fig 1) of a tube stand bolted to the floor and supported at the top by attachment to the wall. The cassette holder slides freely on the tube stand for quick adjustment to any desired height. It is also adjustable so that it can be tilted to any angle, and is made with a bakelite face or panel in which has been cut an aperture for the nose in conformity with the principle of the Granger sinus board. The cassette slides into the holder or is held against the face of the board (figs 3 *A* and 4 *A*) for the purpose of making exposures when the Granger position is not used. The tube carrier itself is so mounted and counterbalanced that it can be raised and lowered, or rotated to any angle. In addition the tube

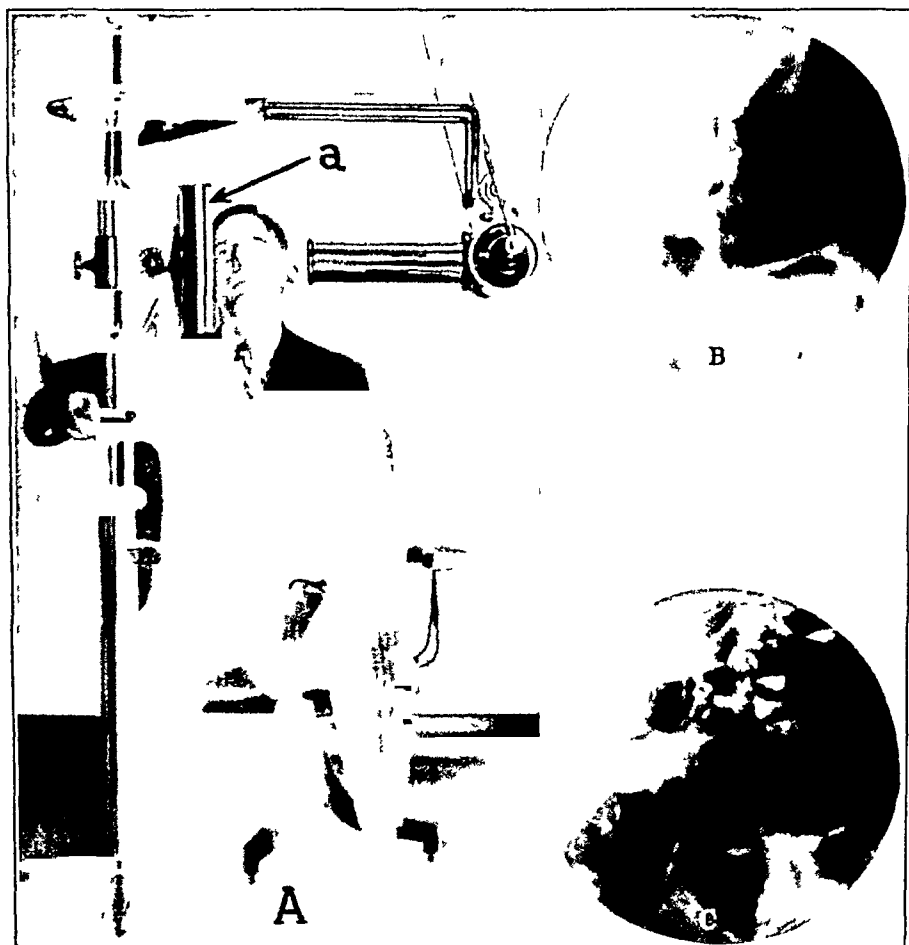


Fig 3—*A*, lateral position. Note location of cassette on face of sinus board at *a*. *B*, lateral film, without contrast medium. *C*, lateral film with contrast medium.

stand is marked to conform with marks on both the cassette holder and tube carrier so that all parts of the apparatus may be lined up at these points by simply setting the markers to coincide. Thus, the ray is centered on the film without necessity for further adjustment and without depending on chance or guesswork for accuracy of centering. The long cone, pressed firmly against the crown, serves admirably for steadying the head, thus eliminating the necessity for more elaborate head holding apparatus. The adjustable shelf can be raised

or lowered as needed and may be used for the conventional positions in sinus or mastoid work including the making of stereoscopic exposures. It swings out of the way and may be used as an arm rest at other times (fig 1 *A*).

I wish particularly to call attention to the use of the apparatus for making exposures in what I have termed the chin-vertex position (fig 4 *A*) which I have been using for some time as the position of choice for delineation of the sphenoid and ethmoid sinuses, particularly when a contrast medium is used. This position is a modification of the one described by Pfahler¹ for roentgenography of the base of the skull and affords a view of the cavities in the vertical plane. I have found the position admirably adapted to this method when modified as shown. *B* and *C* in figure 4 show films made in this position with and without filling.

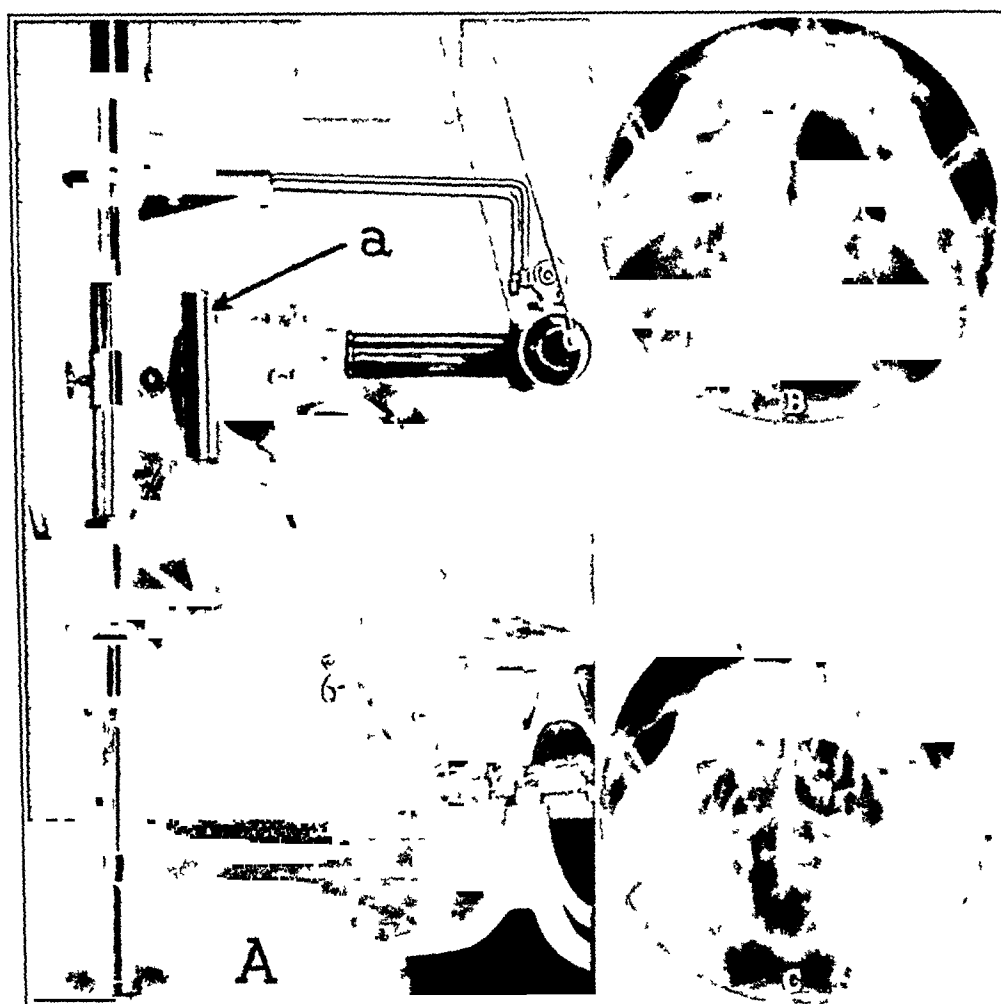


Fig 4—*A* chin-vertex position. Note location of cassette on face of sinus board at *a*. *B*, chin-vertex film without contrast medium. *C* chin-vertex film with contrast medium.

SUMMARY

This apparatus incorporates the following advantages:

1. It permits the making of roentgenograms of the head while the patient is sitting.

¹ Pfahler, G. E. Roentgenologic Signs Which Indicate Extension or Infection from the Ethmoid and Sphenoid Sinuses to the Base of the Skull. *Tr. Sec. Laryngol., Otol. & Rhin.*, A. M. A., 1928.

- 2 It applies the principle of the horizontal ray in a convenient manner
- 3 It provides a quick and simple means of centering the ray on the film, thus permitting the use of a small cone with unfailing accuracy
- 4 It is also adapted to the positions in common use at the present time

510 Republic Building

A NEW OPERATIVE TREATMENT FOR ATROPHIC RHINITIS WITH OZENA

Preliminary Report *

IRVING I MUSKAT, M D, CHICAGO

Associate Surgeon, Illinois Eye and Ear Infirmary

Up to this time there have been many methods of approach for the cure and relief of patients with atrophic rhinitis with ozena, based on the various clinical and pathologic interpretations of this malady by different investigators. From a survey of such work one comes to the conclusion that notwithstanding the fact that the etiology of this disease is still shrouded in mystery, the better results in its treatment have been obtained from operative procedures which have had as their object the reduction of space of the nasal chambers. This has been accomplished to some extent by the methods of Lautenschlager and Halle, whereby the nasal chambers are reduced in size by bringing in the lateral nasal walls.

As these operations were formidable and are now seldom used, there have evolved the operations of implants and transplants consisting of bone, rib, cartilage, fat and ivory, which are placed under the mucous membrane of the septum. The reduction in space of the nasal chambers has also been accomplished by the injection of paraffin or blood under the mucous membrane as well as the placing of sterile petrolatum under the mucous membrane of the floor of the nose by a pocket made through the under surface of the upper lip.

The procedure of these injections and transplants proved to be simpler than the cumbersome and difficult operations of Lautenschlager and Halle and their modifications, but the results were not better. The failure to relieve the atrophy of the mucous membrane and crusting with its fetor is no doubt therefore due to some extent to the nature of the grafts and implants thus far used.

The objections to these implants are that they either are foreign bodies or become absorbed. Autogenous grafts such as bone, rib or cartilage entail the removal of vital parts from another place in the body. To overcome these objections I have chosen the transplantation of fascia lata from the thigh as the ideal method. The transplantation of fascia lata becomes the ideal material and method when its many advantages and virtues are considered. Fascia lata is readily accessible and can be obtained in almost unlimited quantity. Its removal from the thigh does not disturb the function of the limb in any way. Its texture lends itself to any manner of accommodation as a graft. It is an autogenous substance and requires a minimum of nourishment to retain its viability. It is a sturdy, strong tissue and is not easily infected. Furthermore, because of its histologic nature its physiologic function as a graft gives it added clinical value. Thus as a transplant

fascia lata is so thin that it is easily permeated by serum. It shows little or no degenerative changes after direct transplantation and does not become encapsulated.

These virtues have been proved in the use of fascia lata grafts in many other phases of plastic surgery, and its value as a graft now becomes paramount in the treatment for ozena. Its use here gives support and nourishment to the atrophic mucous membrane and reduces the size of the nasal chambers.

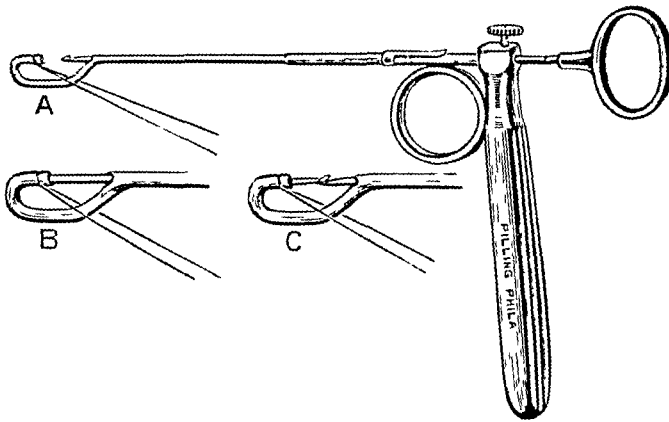
I have operated on one patient with marked atrophic rhinitis with ozena by the transplantation of fascia lata under the perichondrium of the septum and periosteum of the base of the nose, and I am reporting its use for the first time in this condition. The technic and results of this operation will appear in a later communication.

30 North Michigan Boulevard

NASAL SUTURING INSTRUMENT

C ARBUTHNOT CAMPBELL, M D, STEUBENVILLE, OHIO

To shorten the duration of an operation and simultaneously to smooth the technic are my endeavors. Both rhinologist and patient complain of the suturing in a submucous operation (mucous membrane of a submucous resection of the septum). Many physicians have ceased to use sutures. The instrument here



Instrument used for nasal suturing. *A* shows the instrument threaded for use. *B* shows the needle pushed forward and engaged in the open end of the tubular portion. *C* shows the needle drawn, bringing the suture with it.

presented is an attempt to aid from several points of view, and makes it possible to suture to a depth of several inches in the nose.

The instrument consists essentially of two parts. A tubular section with a handle attached and a barbed needle which slides back and forth in the tubular part. The tubular part is bent, as shown in the illustration, to receive the needle when it is propelled forward, and is slotted crosswise about one sixteenth of an inch (0.15 cm) from the end to receive suture material.

In the picture, the sectional cut *A* shows the instrument threaded for use. *B* shows the needle pushed forward and engaged in the open end of the tubular portion. *C* shows the needle drawn, bringing the suture with it.

* Submitted for publication Oct 24, 1929

After the needle is threaded, two flaps are approximated by forceps, and with one movement the needle is passed through both flaps. This is quickly and easily done. The suture is readily tied. In cases in which it is inconvenient or impossible to follow the technic given, the threaded needle may be passed through one flap, rethreaded and then passed through the second flap, the silk is then tied. The deeper the suture is to be placed in the nose, the greater the dexterity that is required. It can be readily seen that the advantages of this technic are (1) simplicity, (2) accuracy, (3) speed and (4) ability to suture to a depth of several inches in the nose.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the
Field of Otolaryngology

FUNCTIONAL EXAMINATION OF HEARING, DEAF- MUTISM AND EDUCATION OF THE DEAF

ROBERT SONNENSCHN, M D

CHICAGO

One of the most striking facts that I have noted in looking over the literature from Oct 1, 1928, to September, 1929, is that so few articles on functional testing of hearing have appeared in the European journals. It has been my usual experience to find that most papers relating to this subject have for a good many years appeared especially in the German journals. This last year they have been absent so far as I have been able to determine. I have found one article in French dealing with the audiometer of the type most used in America, and all the other papers were those which appeared in England and in this country, particularly the latter. This is a decided reversal of form from that which was observed in previous years when American or English writers seemed to deal with this subject only on rare occasions. It can be accounted for only on the assumption that in Central Europe attention has lately been directed more to operative procedures, pathology, etc., and much less toward devising new tests for hearing or modification of the older tests. On the other hand, it is encouraging to note the increasing interest English speaking writers are evincing in the careful functional testing of hearing. Altogether the articles that have appeared throughout the literature are much less numerous than usual, and this makes the review much shorter than it has been during the past few years.

It is a curious thing that some years more attention is paid to certain items than in other years. About two years ago, the interest in audiometers was intense, and many articles were written regarding them. During the past year, the question of malingerers, especially of simulated total unilateral deafness, has brought forth a number of papers. Practically all of the articles rest on the principle that when the ear which is supposed to be deaf is masked, the subject cannot tell whether he hears the sound in the opposite or admittedly better ear. Various types of apparatus have been employed, but I am still of the opinion that the simple Stenger test answers all requirements. In England a number of men have endeavored to establish a method for obtaining definite units as applied to defects in hearing. Their mathe-

mathematical formulas, however, in the opinion of some physicists, do not fulfil the requirements of designating exact units

After this review had already been prepared, there appeared in a supplement to the *Acta oto-laryngologica*, an article by Dida Dederding, entitled, "Clinical and Experimental Examination in Patients Suffering from Morbus Meniere, Including a Study of the Problem of Bone Conduction" This is a detailed account of the examination of 135 patients and takes into consideration every standpoint of diet, physical condition, etc The main thesis is that of Meniere's disease, but considerable attention is also paid to bone conduction This article will be read and a review submitted next year

T A Clarke¹ reviewed the functional tests thoroughly, emphasizing their shortcomings and in addition described means of placing auditory tests on a rational, accurate and convenient basis In testing tonal range limits he said that the audiometers are not of great value He stated the belief that the monochord is a convenient and accurate agent for testing the upper limit of hearing The monochord has the advantage that its sounds may be transmitted by bone conduction In every case of deafness, conductive or perceptive, the upper limit is lower by air than by bone conduction, and often to a marked degree I also found it to be so in normal persons, I quoted Kalahne for an explanation

The Schwabach, Weber, Rinne and Bing tests fail to justify their prominent place in the routine testing of patients because they give incomplete and often misleading information In referring to Gelle's test, Clarke presented results obtained in eighty cases His results show that first, otosclerosis has little or no influence on the result, second, that the test is unsound in theory, for it is as frequently positive when the drum is perforated as when the drum is intact, and third, he suggests that the significance of the Gelle phenomenon is still unknown

Under the suggested improvements in qualitative testing, he advised the use of the absolute bone conduction test to determine readily and accurately the perceptive component Certain elementary points require attention in carrying out the test The meatus should be occluded without an increase in pressure which can be accomplished either by pressure on the tragus or by inserting the moistened finger into the meatus Any fork between 128 and 1,024 double vibrations per second may be used, preferably the 256, 512 and 1,024 forks In normal cases perception by absolute bone conduction is slightly less than by air conduction Conductive disease results in loss of hearing power by air conduction with normal perception by absolute bone conduction Perceptive deafness involves diminished hearing by both air conduction and absolute bone conduction with the excess of air conduction being if anything increased over the absolute bone conduction The absolute

1 Clarke, T A Hearing Tests, *J Laryng & Otol* 44 83 (Feb) 1929

bone conduction test affords an absolute index of the perceptive function, whereas the Schwabach test is influenced perhaps simultaneously by changes in both perception and conductive functions and is, therefore, indicative of neither. Bone conduction as such does not exist, but it is really conduction by resonance. The sound vibrations produced when a tuning fork is placed on the skull are conveyed to the cochlea not by conduction as such but by sympathetic resonance of the cranial structure. Under such conditions, one would expect that the effective stimulus would be no greater in the region of application of the fork than at a distance. The existence of this condition by resonance conveys important implications affecting the performance of and deduction from the tests. In view of this resonance conduction, the use of the Bárány noise machine in the ear opposite to the one to be tested is required less frequently in the absolute bone conduction test than in the relative bone conduction test. This is explained by the presence of cross-stimulation which is dependent on bone conduction by resonance. With this present, it is impossible without special precaution to demonstrate any loss of sensitivity greater than that which requires a stimulus so loud as to effect the ear opposite that tested. When this cross-sensation is anticipated, the Bárány noise machine must be used to exclude the opposite ear. In the Schwabach test the normal sensitivity of the two ears is equal, and to demonstrate any degree of reduced sensitivity a Bárány box is essential. However, in the absolute bone conduction test the normal sensitivity of the ear tested is raised considerably above that of the opposite ear in which the meatus is not being occluded, enabling one to demonstrate a considerable degree of nerve deafness before a Bárány box becomes necessary.

Quantitative testing is even less satisfactory than the qualitative. There is a great need for a method of quantitative testing which will yield accurate results and be comparable whenever obtained. Of the various expressions for hearing defect that of the normal hearing distance is the most valuable, rendering results which are intelligible even to the untrained mind. If one has a 10 per cent normal hearing distance, it is readily understood that he is able to hear a sound only one-tenth the distance that it is heard by a person with normal hearing. It is also a natural instinct to speak of deafness, the loudness of sounds, and hearing in general in terms of distance. For this reason the tests which are on a distance basis as the voice, watch or acoumeter have been most used. These tests have more disadvantages than advantages for quantitative testing. The audiometer which is a great advance will probably never come into routine use because of its complications, lack of portability and cost.

The tuning forks which are essential for qualitative testing deserve considerable attention in the consideration of quantitative determinations, since their results can be expressed in terms that are both convenient

and universally applicable. The two methods which have been used, the fractional, and the expression of hearing defect as the number of seconds deficiency for a fork, are not accurate. The expression of hearing power merely as seconds deficiency for a fork ignores the wide differences in the rate of decrement of forks, and the fractional method does not consider the initial amplitude of vibration of the fork, which varies widely not only in different forks but also in the same fork. Attempts to overcome these defects by producing forks of universal and constant initial intensity as well as universal similar decrement have met with little success, and it is doubtful whether future attempts will meet with greater success.

Clarke suggested a method whereby both the expression of hearing power in terms of percentage retention of normal hearing distance, and the tuning forks are utilized. The hearing is tested in the usual way, and the duration of after-perception of a tuning fork noted by the normal ear after the patient has ceased hearing it is noted in seconds, seconds of deficiency. The figure is then translated into percentage of retention of normal hearing distance by reference to a table. Such a figure is open to comparison and will be identical with the results for the patient examined with other forks or instruments of the same pitch. This table could be supplied by the makers of the forks at the time of purchase or can be either drawn up at the expense of little time with the aid of a few experiments and a little practice in mathematics or standardized by a central institute. If quantitative estimation for only a single pitch is wanted, reference to a small printed table will be convenient, if complete testing for a range of forks is wanted, a graph recorder as suggested by Lowndes Yates could be used. The objection to the test is that a second personal factor is introduced. However, with only a little practice one is able to say with confidence when the end point of perception of the fork is reached. Normal hearing for the examiner is essential. No special tuning forks are needed for the test. The low forks, however, should be as free from overtones as possible with a fairly rapid rate of decrement so as not to make the test too tedious. The higher forks should be of good quality with as slow a decrement as possible. The translation of results from seconds deficiency for any fork to percentage normal hearing distance is merely a matter of referring to the table. The mathematical and physical basis underlying the test and for obtaining the figures on the table is presented in detail.

For quantitative estimation of perceptive function the absolute bone conduction test can give valuable information. The end point of perception in testing absolute bone conduction cannot be obtained with the same accuracy as in testing air conduction. The value of the test is also confined to pitches between 728 and 1,024 double vibrations per second. The factor of auditory fatigue which can be greatly overcome by lifting

and replacing the tuning fork is also recommended. The efficiency of contact between the base of the tuning fork and the skull plays a large part in determining the amount of perception in this test. With a little practice, one can learn to use a fairly constant degree of pressure, thus reducing this error to negligible proportions. The quantitative estimation depends on the expression of "absolute bone conduction" in the terms of air conduction. In testing a patient, one determines the end-point of his perception by absolute bone conduction and then determines how much longer the sound is heard by the normal subject. This seconds deficiency of absolute bone conduction cannot be compared to seconds deficiency of air conduction because of the more rapid decrement of the fork's vibration when applied to the mastoid entailing resonance of the cranial structures. The increase in decrement is determined for each fork with sufficient accuracy for all ordinary purposes and is explained by Clarke with an example. The patient's absolute bone conduction need not be compared with the normal absolute bone condition. This seconds deficiency as compared with the normal perception by air conduction may be determined when the interval between the normal air conduction and the normal bone conduction is known. The results so obtained for absolute bone conduction can be directly compared with those obtained from the tests of air conduction and then translated into percentages of normal hearing distance by referring to the same table previously mentioned. This is readily graphed or expressed in a fraction when the patient's absolute bone conduction expressed as percentage normal hearing distance is placed over the normal percentage absolute bone conduction for normal hearing distance. Clarke then gave his complete personal procedure of examinations, which he stated occupies only twenty minutes including the production of graphic records. First he tests with the watch or the acoumeter if the distance is small. Then the patient occludes both meatuses, and a vibrating tuning fork is placed on the glabella. If there is any lateralization of perception, he knows there is a unilateral or unequal bilateral perceptive deafness. A fork preferably *c-1*, 256 double vibrations, is held close to the tragus and when perception ceases, it is transferred to the base of the mastoid occluding the meatus by pressure on the tragus with a finger of the other hand. When perception ceases the fork is transferred to the experimenter's mastoid to determine whether there is any further perception by absolute bone conduction. If there is then the patient has some additional perceptive deafness. Quantitative estimations for the two ears may be performed at the same test, but air conduction and absolute bone conduction are best tested separately. All the necessary particulars are in the decrement table. Then he tests with the *C-5* fork and usually tests the upper limit (Monochord air conduction and bone conduction) and the lower limit. If complete investigation is required,

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he then proceeds to do quantitative tests for all the forks, C-1 to C-5 by air conduction, C-1 to C-3 for absolute bone conduction

In conclusion, he stated that he had outlined methods for accurately determining the total hearing power (air conduction) and the perceptive function (absolute bone conduction), from which data the condition of the conduction apparatus can at once be deduced. The results are expressed intelligently and are comparable whenever and by whomever they may be obtained. If necessary, they can be expressed in graphic form. Such full testing carried out as a routine would result in some reorganization of ideas and the general improvement of otology.

F. W. Kranz stated the belief that the older tests are not sufficient. Considering "total hearing ability," "conductive ability," and "perceptive ability," the first is the sum of the other two, and if two can be measured, all will be known. Test of absolute bone conduction will give perceptive component. That this is a true index of purely perceptive function is shown by the fact that almost anything can happen in the middle ear or to the tympanum and cause no appreciable difference in results of this test.

Normally absolute bone conduction is slightly less than air conduction. Tests of total hearing can be made and defects can be expressed in several ways, e. g., arbitrary units, sensation units, etc., or on a hearing distance basis. The author chooses the last method. He adopts a scale which is really a purely arbitrary one on the assumption that hearing power is directly proportional to the distance at which a given sound can be heard. Thus by comparisons of deaf persons and persons with normal hearing, he arrives at a percentage of normal hearing distance to express the patient's hearing power. If forks are used for testing, the time difference can be translated into a distance ratio by means of a table prepared by preliminary experimentation with the fork.

It seems that his "quantitative" scales for measuring bone conduction and also total hearing are both arbitrary inventions, and subject to change with change of fork, etc. Certainly the results are not in such units as allow a conclusion that the difference in the numerical results of the two tests represents the air conduction in any rational or universal units.

The author's statement regarding "10 per cent normal hearing distance" as representing one-tenth normal distance heard is misleading, as most persons then believe that means one-tenth hearing ability, whereas it probably means one-hundredth or less according to the inverse square law.

I believe the author is somewhat mistaken regarding the initial amplitude of forks. Unless the same fork is struck with markedly different force, its initial amplitude is practically the same each time. If a pendulum blow or impact with a pleximeter is used, employing the

same arc of fall in striking the prong at the "percussion point," sufficiently uniform excitation is obtained for all practical purposes

In this rather detailed article, Devaux² described the audiometers and the methods of their use. He based his work on that done by Americans, especially the men connected with the Western Electric Company and the Bell Telephone Laboratory. The bibliography is complete, and all of his references are to articles by English and especially American investigators, with the exception of those of two Frenchmen. Fletcher and Wegel are especially quoted, but the work of Fowler in this country and that of Dan Mackenzie in England are mentioned. It is refreshing to read a foreign article which shows the intimate knowledge and the acquaintance with the various steps of the excellent research work done especially in this country in the way of the development of the audiometer, etc. In his conclusions the author stated that the new method of testing hearing has furnished something new and important, namely, the sensation unit. The audiometer is simple in its manipulation, and gives a graph or curve which is a record of great precision. In order to supplant testing with the whispered and conversation voice, Devaux also mentioned the fact that the phonograph audiometer may be used. By means of an instrumental examination, he believed that one will be able, by this method of precision, to supplant and do away with the personal observation of the examiner. He further stated the belief that the use of this instrument will result in the acquisition of much knowledge regarding the physiology of hearing.

I wish to say that Shambaugh has repeatedly stated that the audiometer, especially the *A-1* type, is of greater value in research of otologic problems than it is as an instrument for practical results in the functional testing of hearing as compared with tuning forks. Devaux believed not only that the audiometer is of use in the clinic, but that it is valuable for testing the employees in various kinds of work such as railroad, and last but not least, it is of great aid, especially when the phonograph audiometer is used in testing children.

This excellent article will prove a mine of information for French readers, but because of the fact that the development of audiometers in Europe has been rather recent, it will not be easily assimilated at once because foreigners have not been educated in this regard to the extent that obtains in the United States. In fact, it was pointed out in the review of last year that only comparatively recently did the German investigators start developing audiometers to any considerable degree, and the models that they previously produced have been much simpler than those developed by the Western Electric Company.

² Devaux, H. C. Un procede nouveau d'accoumetrie, *Ann d mal de l'oreille du larynx*, 48 27 (Jan) 1929

Hastings³ stated the belief that the comparative ignorance concerning both the pathology and the treatment in so many cases of deafness of both the middle and the internal ear types is due in part to the methods of examination which have been used in the past. He expressed the feeling that for a scientific study of deafness arbitrary units of hearing must be given up and an attempt made to discover what percentage of the normal power of conduction and the normal power of perception is present for pure sounds of the principal wave lengths. The ordinary method of estimating bone conduction by means of a vibrating tuning fork placed on the mastoid is open to a thousand fallacies, since the more complete the interference with conduction through changes in the middle ear, the longer will the sound of the tuning fork be heard. One of the tests recommended by a certain committee in 1917 was the "absolute bone conduction" test. This test is carried out by having both examiner and patient block his external auditory meatus with his finger, and placing a vibrating tuning fork alternately on the mastoid of the examiner and the patient until it is no longer heard. Thus the bone conduction of the two persons is compared. Hastings stated that as long as he has used this test he has never found any case in which the absolute bone conduction is increased beyond the normal. The statement that bone conduction is increased in otosclerosis is erroneous when applied to absolute bone conduction. Obstructing the meatus increases the perception for bone conduction considerably. Therefore if the degree of bone conduction in the two ears is approximately equal, the test will not be vitiated by a conductive deafness in the untested ear regardless of how great the impairment may be. Difficulties will arise only when there is a marked perceptive deafness on the side being tested, with good cochlear hearing and considerable conductive deafness on the other side. In such a case the patient will immediately say that he hears the tuning fork in the opposite ear, and then the ear not being tested can be excluded with a noise machine or by rapid movement of the finger in the meatus. With the "absolute bone conduction" test it is possible to estimate the percentage of normal perceptive hearing retained by a patient by noting the difference in time between the bone conduction of the patient and the examiner and then translating it into percentage by means of a table given for this purpose. The total hearing power and percentage can be figured according to the methods of Lowndes Yates, Clarke, and others by noting the differences in time that a fork held at similar distances from both the patient's and the examiner's ear is heard and then converting them into percentages by means of a table or graph. With both the percentage

³ Hastings, S. Estimation of Hearing Capacity, *J. Laryng & Otol* **44** 73 (Feb.) 1929

for total hearing and the percentage of perceptive hearing known, it is easy to determine to what extent the deafness, if any, is due to changes in the conduction apparatus. Although these methods are laborious and crude, there is no other at present that will tell the examiner what he wants to know. This author stated the belief that "our investigations regarding otosclerosis or other researches will not prosper until we have standardized methods for testing ears and estimating hearing capacity."

It is well known (Bing's test) that occlusion of the external auditory meatus will increase bone conduction in the normal subject or even in one with some involvement of the inner ear, but when bone conduction is already lengthened in a case of impairment in the conduction apparatus, it will not increase bone conduction.

The author repeated the old fallacy of misapplication of the law that intensity of sound varies inversely as the square of the distance. It should be understood that this law applies only to a point source of sound and to conditions of no reflection of sound. A tuning fork is far from a point source, and usual rooms have considerable reflection, so calculations on the basis of this law are valueless.

For total hearing power of the patient the author takes the time the patient hears the fork and the time a normal person hears it at the same distance. From a table he converts time deficiency into space deficiency, and the square root gives the power ratio. According to Kranz, it does not do so. Extension of this to bone conduction takes the time deficiency of the patient's bone conduction as compared with the air conduction of the normal and translates this into space deficiency according to this table. He does the same for normal bone conduction and air conduction and then compares the patient's bone conduction deficiency with normal bone conduction deficiency. "This is highly artificial as normal air conduction is not more of a standard than normal bone conduction, and space deficiency is no more of a standard than time deficiency. Far better use standardized or calibrated forks and deal only with observations of time. The measurements are not made any more absolute by the author's procedure (Kranz)."

Keen⁴ found in the course of applying the hearing test to pensioners that the hearing distance for both ears together often exceeded that for the better ear when the hearing distance was determined in a forward direction, i. e., by facing the patient and taking special precautions to exclude lip reading. Some evidence is produced to show that this addition actually occurs in mathematical proportions. The physical considerations are based on the well known law in acoustics which states that the intensity of a sound wave spreading out from a point varies inversely as the square of the distance from this point. The difference

⁴ Keen, J. A. Intensity Perception in Monaural and Binaural Hearing, *J. Laryng. & Otol.* 44: 315 (May) 1929.

in the hearing distance when both ears are tested together is not always obvious. In measuring the hearing power of the ears in terms of distance the difference between the two sides may be expressed as the square of these distances. The combined distance X would be given by the formula $X = \sqrt{D^2 + d^2}$ where D and d are the hearing distances of the better and worse ear, respectively. The argument and formula are worked out in detail. Examples of hearing tests are given to show this relationship. Many persons however, do not conform to this principle, which is probably due to the approximate nature of all voice tests for hearing. In testing with the observer facing the ear, there is an advantage in that the sound waves coming from the side are more easily collected and directed into the meatus than are those coming from a front position. Furthermore in sideways testing there is the additional advantage of eliminating lip reading without any special precautions. The various difficulties found in hearing tests, such as control of voice, fatigue phenomenon on the part of the patient, size and shape of the room, etc., could easily produce the differences found in some of the cases. In addition it may be found that the increased hearing power of both ears is present only when the source of sound is placed in the medial plane of the head resulting in sound vibrations reaching both ears in exactly the same manner. The wireless ear phones and the stethoscope provide an illustration of this greater power for intensity perception of both ears together as compared with that of each ear separately. The audiometer type of apparatus may possibly supply the actual proof of this phenomenon.

The various theories of intensity perception are discussed as applied to the group of hearing tests discussed. In the examples shown the threshold value is lowered when both ears are receiving the sound impressions as compared to the minimal intensity required when only one ear is listening. This is easily explained on Boring's hypothesis which states that the louder the note the larger is the number of cochlear nerve fibers stimulated. The law of Adrian postulates that the louder the note the greater is the frequency of the rhythmic impulses travelling along the identical number of cochlear nerve fibers. According to this law, a source of sound must be sufficiently strong to stimulate a certain number of nerve endings on the basilar membrane before an impression of sound is received. If both basilar membranes are being stimulated, the source of sound could be less intense and still might produce an auditory impression.

Lemere⁵ has worked out a chart whereby the readings of the audiometer can be recorded at once in percentage, as quickly and as easily as

⁵ Lemere, H. B. A Percentage Chart for 2-A Audiometer, *Arch. Otolaryng.* 9:442 (April) 1929.

they are now recorded in sensation units. Two charts are presented, one with directions for its use, and the other an illustration of an audiogram in a case of progressive deafness. The advantage of this chart of percentage loss is that it gives a clearer idea of the proportionate loss of hearing for each note as related to the whole range of hearing, and it involves less labor and less likelihood of error than the conversion method now relied on.

For those who use the audiometer as a routine in practice or in the clinic, such a percentage chart may prove of considerable value.

Three hundred and fifty-three patients in the medical and surgical departments of the Johns Hopkins Hospital who had no subjective indication of deafness were tested with the Western Electric 1-A audiometer tones, from 32 to 16,384 double vibrations being used as stimuli. The records were grouped according to the ages of the patients, and the threshold readings were tabulated in the form of "scattergrams." The mean variations for the threshold readings were calculated. The mean for all groups differ very little for tones under 512 double vibrations. Observers over 60 years of age have an average threshold which is lower than the other groups for 512 double vibrations. Those in the fourth decade hear 2,048 double vibrations as well as those in the third, but each successively older group shows increasing loss for this tone. For tones of higher pitch, each successive age group shows a decrease in sensitivity, few in the older groups being able to hear the high pitched tones produced by the audiometer at its maximum intensity (Bunch⁶).

It has been long held that the hearing for high tones diminishes considerably with increase in age after middle life, and this excellent article offers much evidence to confirm this view.

It is an important matter to recognize gross variation in the sense of hearing and to determine the seat of the disease and the cause, if possible. This is of value in the military service,⁷ especially when the degree of remaining hearing can be stated in concrete terms so as to enable one to determine the trend of the disease, the proper treatment and environment and to establish a more accurate prognosis. If this can be determined by a procedure which can be performed in a standard manner by different competent observers at various times, it becomes particularly valuable and can be placed on a similar accurate basis as eye, blood pressure, etc.

The audiometer presents the easiest means for determining accurately air conduction auditory acuity but is inferior in the estimation of bone conduction and for the necessary comparison of bone conduction and air conduction. In addition, the audiometer is expensive. Both air and

6 Bunch, C. C. Age Variations in Auditory Acuity, *Arch. Otolaryng.* 9 625 (June) 1929.

7 Sonnenschein, R., and Reasoner, M. A. The Use of Standardized Tuning Forks and Hearing Tests in the Military Service, *Mil. Surgeon* 64 169 (Feb.) 1929.

bone conduction auditory acuity can be determined with a set of properly calibrated tuning forks. They are not expensive, are easily transported and are essential in other tests of the auditory apparatus. As a matter of simplification and standardization the routine yearly physical examination might be accomplished with the set of tuning forks. It is true that with a limited number of forks determinations cannot be made at eight different pitches as with the 2-A audiometer, but a sufficient number can be made to cover all necessary purposes. With the assistance of Drs. Mackenzie, Hettrich, Parker and members of the Committee on Standardization of Tuning Forks and Hearing Tests of the American Academy of Ophthalmology and Otolaryngology, a selection of forks was made and a complete detailed list of specifications drawn up. These are represented in this paper.

A substitute for the steel fork is the new magnesium alloy fork, which was developed at the Riverbank Laboratory and presented and first described by Sonnenschein in the annual report of the committee on standardization of tuning forks and tests of hearing in 1927. The two great advantages of the magnesium alloy forks are that they are rust proof and extremely light. The overtones of the lowest pitched forks are no greater than those of some of the steel forks. The duration by air conduction is as good as that of the steel forks with the exception of the c-4 and c-5 forks. These are much shorter than the steel forks, whereas the remainder of the forks vibrate as long and some even longer than the steel forks of the same pitch. For bone conduction the magnesium forks do as well as the steel ones. A series of these forks from 16 to 4,096 double vibrations has been perfected which will in all probability cost less than the first class steel forks. The damping constant for these forks can be determined at a cost of about a dollar and a half, which is somewhat lower than the charge made by the Bureau of Standards for steel forks. Whether these forks will eventually replace steel forks one cannot state definitely at the present time, but it is believed that this type of fork should be more extensively studied so that some definite conclusion can be made regarding it.

A list of the requisites which good forks should have as well as the method of excitation, the application to the patient, the determination of loss of hearing in sensation units by means of the known damping constant and the overcoming of overtones is presented.

The routine method of testing the hearing consists of general inspection, the preliminary tests of hearing, using the whispered voice or the watch and Politzer acoumeter which are not so satisfactory and practical, and the determination of the upper tone limit, using the Edelman-Galton whistle or preferably the monochord and the tuning fork tests. The most important tuning fork tests are the Weber, Schwabach, Rinne and the Stenger. These are all discussed thoroughly

It is a general rule that the middle ear should be inflated after the tuning fork and voice tests. If improvement is then manifested, the prognosis is good, if there is no improvement, the prognosis is generally unfavorable. In conclusion, a complete recapitulation of the principal hearing tests is presented.

Mackenzie⁸ described briefly those methods for detecting simulated unilateral deafness which have proved most reliable to him in an experience covering the study of a fairly large number of cases. A careful history is important, and occasional remarks as of neglect following a slight injury may lead one to suspect a possible case of malingering. A malingerer usually presents an exaggerated effort to hear as compared with a person who has true deafness. There is a lack of cooperation on the part of the malingerer, usually manifesting itself in the functional tests of hearing, in which variability of results are generally present. There is usually a hesitancy or delay in the patient's replies showing itself most typically while tests with the conversational voice are being made. The patient usually asks to have the word repeated several times before suddenly answering as though the word had just become apparent to him. In repeating, he will repeat incorrectly words or numbers having no resemblance to those asked. Tinnitus and vertigo are usually absent in cases of malingering. The absence of bone conduction over the mastoid of the deaf ear is a characteristic observation in unilateral simulated deafness. There is also an absence of hearing with the Weber test when the meatus of the good ear is closed with the finger. This should ordinarily increase the sound in the ear, but the one feigning deafness will claim that he ceases to hear the fork altogether even though he may state he heard it before placing the finger in the canal of the ear. He will also fail to speak in a louder tone when a noise apparatus is placed in his good ear, because he is still able to hear with the supposedly deaf ear. The Stenger test which is by far the best single test in these cases is positive for malingering. The Western Electric Company has now devised an apparatus known as the 42-A Test Set which is recommended for use in the detection of malingering. Mackenzie stated the belief that this is a good substitute for the pair of *a-1* forks of Bezold and has two advantages: first, a constant stimulation which is not possible with the forks, and second, a stimulation of equal intensity on the two sides which is difficult to obtain by stimulating the forks when striking the prongs. However, one of the advantages of the forks, namely, high intensity at short range with low carrying power, has not as yet been attained by the electrical instrument. The fork, though loud at close range, can hardly be heard 8 inches from the ear,

⁸ Mackenzie, G. W. Simulated Unilateral Deafness, *Laryngoscope* **39** 103 (Feb.) 1929

preventing any possibility of the sound being carried to the opposite ear. The result obtained thus far with the Stenger test and the electrical instrument have been the same. At the present time it seems that the advantage of the Stenger test in the long run may outweigh those of the electrical instrument.

There is also an absence of symptoms and signs referable to the nonacoustic labyrinth in cases of simulated deafness. A person giving a history of sudden total simulated deafness with the absence of spontaneous nystagmus when looking straight ahead is open to suspicion. Furthermore, if the rotation tests are normal for that labyrinth, and finally if the galvanic test reveals normal reactions for both sides, there can be no doubt that the vestibular mechanism is intact and functioning normally.

The detection of unilateral deafness is important both in cases of suppuration and from a forensic standpoint. The common methods of excluding the normal ear from hearing as the moistened finger or a Barány noise apparatus are not entirely satisfactory, for they do not nullify completely the hearing in that ear. According to Bezold, sound can be transmitted to the normal labyrinth by means of bone conduction, for he showed that when a 480 double vibration tuning fork was held in front of the ear, the labyrinth of which had been extirpated, the sound was still heard by the patient. The noise apparatus in addition has also the advantages that when placed in the normal ear, it deafens not only that one, but to some extent the diseased ear, so that if a small remnant of hearing is present, it may not be recognized because of the noise apparatus.

This test is based on the physiologic fact that during the perception of one sensation a second sensation can be perceived at the same time only when it differs within certain limits from the first sensation quantitatively or qualitatively or in both respects. The minimum difference needed for the contemporaneous perception of two sensations is called differential threshold. When two tones of identical frequency and considerable differences of intensity are introduced simultaneously, one in each ear, only the tone of the greater intensity will be heard and will be lateralized in that ear. Unilateral deafness is determined by placing a telephone receiver connected with the audiometer in the normal ear, and its threshold determined.⁹ Then through a second receiver a tone of the same frequency is introduced into the deafened ear, and its intensity increased until the tone in the normal ear is suppressed and the lateralization to that ear abolished. This determines the threshold in the deafened ear. The detection of simulation is determined similarly and is based on the same line of reasoning.

⁹ Guttman, J. A New Method of Determining Unilateral Deafness and Malingering, *Laryngoscope* 38:686 (Oct.) 1928.

A simple test for exposing malingerers in unilateral deafness is presented by Becker¹⁰. The equipment required consists of a rubber tube about 4 feet long with olive-shaped ear tips at each end and a fairly loud ticking watch. The principle of the test is that when a watch is pressed against a tube the ends of which are inserted in the ears of the patient, at an equal distance from each ear, the ticking will be heard equally loud in each ear. As the watch is moved along the tube away from one ear and toward the other, the sound will be lateralized in the latter and will definitely become monaural in that ear when the watch is held close to it, the distance varying, depending on the acuteness of the patient's hearing. In performing the test, the hearing is first determined in the normal ear by placing the watch tightly against one end of the tube with the other end in the ear. If the patient says he hears it, the test is continued. In the event he does not hear it, the watch is moved along the tube inch by inch until the patient says he hears it, and the distance is then noted. Both tips are then inserted into the patient's ears, and the tube is dropped behind the patient's head. The examiner then applies the watch to any part of the tube between the middle point and the supposedly deaf ear. If, for example, the patient is deaf in his right ear and the watch is placed nearer to the right ear of the patient, the sound will be carried to the left ear, providing the watch is not held beyond the distance of hearing for the left ear, which was determined at the onset of the test. In the malingerer the increasing sound in the right ear will exclude the sound in the left and on questioning he will be at a loss as to what to answer. He may say he hears nothing, exposing himself, or if he is a clever malingerer, he may state that he hears it in his left ear. In this event the examiner pinches the tube closed leading to the left ear, and if the patient still insists he hears it in his left ear, he is exposed. The tube near the normal ear may be clamped before the test is begun and if on questioning the patient states he hears it in that ear, it will be known that he is malingerer. If he states he hears nothing, the clamp is then gradually loosened, and then if he continues to deny hearing anything, he again betrays himself. The test may be made with any ticking instrument, and the tubes may be of varied lengths.

Dr John F Callahan of Brockton, Mass., described a test similar in principle some years ago.

These tests are based on the same principle as the Stenger test in that a louder (nearer) source of sound introduced into one ear masks or drowns the sound entering the other ear. The Stenger test (or its modification by Dr W. A. Wells) is reliable and requires much less

¹⁰ Becker, B. M. A Simple Method for Exposing Malingerers in Unilateral Deafness, *Arch. Otolaryng.* 9:440 (April) 1929.

apparatus than the tubes employed in these various modifications. All that is needed is a pair of balanced forks of the same pitch using either *a-1* (435 double variations) or *c-1* (256 double variations).

The mechanism for the detection of unilateral deafness purposed by Becker¹¹ consists of a shallow cup of a Bowles stethoscope attached to a piece of rubber 12 inches long. At the other end is attached the bifurcated rubber or metal piece of the stethoscope, and to each end of this tip is attached a soft rubber tube, one 12 inches and the other 24 inches in length. The test is performed with a ticking instrument such as a watch, care being taken not to have one too loud so as to be heard outside the tubes, or not loud enough to be heard the length of the tube. The principle of the test is based on two facts: first, that when two tubes of unequal length are used, the sound will be lateralized on the side of the shorter tube, and second, that when one compresses the longer tube through which no sound reaches the ear, a decided change on the opposite ear will be noticed, probably because binaural hearing has been converted into monaural hearing.

In performing the test, either the direct or the indirect method can be used. In the indirect method, the examiner stands behind the patient. The shorter tube is placed in the normal ear, and the longer tube is inserted in the deaf ear. The watch is applied to the stethoscope, and the patient is asked where he hears the sound. He will state in the good ear. The patient is then asked to tell when he hears a change in sound, and the longer tube going to the deaf ear is then compressed. If he states that the sound has changed and seems to approach nearer the ear drum, the examiner knows that the patient is malingering, for if the other ear is deaf no change in sound should be perceived when the tube going to the deaf ear is clamped. If he states that there is no change in sound, the direct method is tried. The tubes are reversed, the longer inserted into the good ear, the shorter into the deaf ear. With the watch placed against the stethoscope, the patient is asked if he hears the sound. If he states that he hears nothing, one knows that he is malingering, because if he is deaf in one ear he should hear the sound in the good ear even with the long tube. If he states that he hears the sound, the tube going to the good ear is gradually compressed, and if he states that he still hears it, he is exposed. When the long tube which leads to the good ear is compressed by the examiner, the patient, if he is malingering, will give conflicting answers and thus expose himself.

This method also employs to a large extent the principles mentioned in discussing Becker's other paper. Why use complicated mechanisms when the simple Stenger test gives excellent results and merely requires

¹¹ Becker, B. M. A Novel and Simple Method for the Detection of Unilateral Deafness, *Laryngoscope* 38:677 (Oct.) 1928.

one or two tuning forks for its performance? These forks likewise are used in other tests, and thus serve two purposes

Grant¹² presented a method devised by Hartmann, in 1898, for obtaining charts of the hearing power for a series of tuning forks. The original instructions were to determine the length of the time in seconds that each tuning fork was heard by the patient, after the duration with these forks for a normal person had been obtained. To obtain the percentage of normal duration of hearing to which this corresponded, the amount was divided by the normal and multiplied by 100. This was modified by taking the differences in hearing in seconds between the normal and the patient and then charting it on a specially ruled chart. The estimation of this actual difference in duration of hearing has an advantage when employed for the purpose of obtaining the percentage of actual hearing ability instead of the mere duration of hearing, from which it differs considerably. According to Hartmann's method, it is assumed that percentage duration of hearing corresponds to percentage of actual hearing power, which could be true only if the tuning fork died away by equal amounts every second as in arithmetical progression. It is, however, well known that this "dying away" is at first more rapid, diminishing with each successive unit of time in geometrical progressions, i. e., with each successive unit of time, the amplitude has to be divided by a constant quantity making the process one of division instead of subtraction. The experimental determination of the constant K for any tuning fork can be carried out at any physical laboratory, and the calculation can be made by any one accustomed to use logarithms. The procedure and physical considerations are presented in detail. It is difficult to state whether the practical value of these determinations compensates for the time occupied. However, there is no question that these investigations constitute a step toward accuracy and are therefore worthy of consideration.

At the International Otological Congress held in Boston in 1912, Dundas Grant presented the important facts relative to the dying down or "decay" of vibrating tuning forks. Judging from the statements one often meets in reading papers on functional hearing tests, many otologists seem to be ignorant of these facts. A restatement of the logarithmic progression is therefore welcome.

Some years ago, working with the Webster phonometer, Sonnenschein¹³ found that the greatest intensity of vibration emanates from the broad or outer surface of the prongs of the tuning fork, a little less

12 Grant, Sir James Dundas. Quantitative Tuning Fork Tests in Relation to the Rate of "Dying Down," *J Laryng & Otol* **44** 381 (June) 1929.

13 Sonnenschein, R. Some Very Accurate Measurements of the Amplitude of Vibration of Tuning Fork Prongs, *Ann Otol Rhin & Laryng* **38** 197 (March) 1929.

from the two narrow surfaces, less from the ends and least of all from the edges or angles formed by the broad and narrow surfaces. It was suggested by Mr. B. E. Eisenhour that probably the shape of the prongs, the distance between the prongs or the relation to the width of the prongs may produce some difference in the relative intensity of one or the other side of the prongs. In view of this suggestion the results obtained in 1924 were carefully checked. The amplitude of vibration was observed through a microscope eyepiece in which there was a scale on which the amplitude or excursion of the prongs could be definitely seen. The fork was activated electrically, and the intensity of sound was measured with the sound meter of Eisenhour.

The results noted were the same as those obtained before when the same forks were used. The shape of the Riverbank fork, and the distance between its prongs were somewhat different from those of forks used in the previous tests, this fork showed a greater intensity from the narrow surfaces than from the outer surfaces of the prongs. Therefore the shape of the fork and the distance between the prongs exert considerable influence in determining which surface of the prongs emits the greater intensity of sound. The longer the distance between the prongs, the more sound can escape. Since there is, however, only a slight difference in the intensity of sound from the outer surface and that from the narrow surface of the prong when held parallel with the ear the same statement made in the original paper still holds true, i. e., "that even though in most forks that I have used the outer surfaces give slightly more intensity than the narrower ones, from a practical standpoint it will make essentially no difference which of these surfaces is presented to the ear provided that the examiner always uses the same method in all his cases so that he obtains uniform and comparable results."

The mechanical aids¹⁴ to hearing are divided into two groups: the electric and the nonelectric. The nonelectric group includes devices such as horns, speaking tubes, conches, auricles, etc., which depend for their effectiveness on the collection and amplification through resonance of the sounds of speech, so that they are conveyed to the ear in intensified form with the least possible distortion. The chief objection to these is their conspicuousness, weight and unwieldiness. In connection with the use of electric hearing aids, Fletcher groups the hard of hearing into four classes: the first, those who hear the conversational voice at a distance of from 2 to 4 feet and who show a loss of less than 30 sensation units in the better ear throughout the range of the human voice; second, those with a loss of from 30 to 60 sensation units for the same pitch

¹⁴ Newhart, H. Aids for the Hard of Hearing, *Laryngoscope* 39:248 (April) 1929.

range, third, those with a loss of from 60 to 80 sensation units, and fourth, those with a loss of more than 80 sensation units. The subjects in the first two groups require an instrument of weaker intensity which can be increased for distances, those in the third group require a more powerful instrument, while those in the fourth group require instruments of special construction with the disadvantage of increased distortion and lessened portability. The larger models, which are not portable, are used for teaching the deaf or in the home or places of business. The telephone companies are now prepared to supply, on a rental basis, special equipment to amplify the sounds of the receiver so that those with considerable loss of hearing can use the telephone with satisfaction. The attitude of the otologist toward these hearing devices should not be to regard them as something to be employed as a last resort, but rather to suggest these aids together with the study of lip reading before the patient becomes severely deafened, thus losing much valuable time and requiring greater effort to reeducate his ears. With the early use of these devices the patient learns to exclude the adventitious sounds they produce, just as the normal person learns to suppress outside noises from lifelong habit. The adventitious sounds are amplified equally with the useful sounds of speech, and constitute the greatest obstacle for the beginner using the electrical device. The patient should be encouraged in his attempts to use the instrument over a considerable period until he acquires the skill to suppress these adventitious sounds, making the advantages greater than the disadvantages. The great advantage of proficiency in lip reading as a supplement to the instrumental devices is not adequately appreciated. It is really indispensable to the hard of hearing. Lip reading enables those with severe loss in hearing to supply the elements of speech which are not heard with the hearing devices. As soon as the otologist discovers a permanent or threatened handicap, he should insist on early study in lip reading. The promotion of a national movement to encourage the proper enunciation and pronunciation of the English language would be of great assistance to the hard of hearing.

The newer instruments are now much lighter, more compact and practically inconspicuous, with the price ranging from \$25 to \$100, depending on the amplification required. Final purchase should be made only after a thorough trial and a careful otologic examination, made more valuable by the addition of an audiogram. No hearing device can remove the pathologic causes of deafness, and every otologist should vigorously combat any claims or statements leading to the inference that the use of electrical hearing devices has a curative effect. The improvement in the ability to hear speech sometimes noticed following the use of a hearing aid is the result of the acquisition of greater skill in the interpretation of speech sounds, and not to an actual increase in acuity for pure tones.

On the other hand, subjecting the hearing apparatus to loud sounds for a prolonged period in the hope of improving the hearing should be condemned as harmful. The otologist's responsibility does not terminate with the prescribing of lip reading or a mechanical device. As long as a remnant of hearing remains, he should impress on the patient the importance of periodic otologic examination, avoidance of upper respiratory and focal infections, improper uses of tobacco, alcohol, etc., in order to preserve if possible what hearing he has, so that he may retain the highest possible hearing efficiency. The otologist should also encourage his patient to become associated with the local organizations for the hard of hearing to aid him in rehabilitating himself as well as overcoming that inferiority complex, lack of confidence and depression which so often overcomes him. With the properly selected instrumental aid, and the mastery of lip reading, the average hard of hearing person has conquered to a great extent his handicap and should without fear be able to assume his share of responsibilities and joys of life.

With reference to mechanical aids, it should be remembered that Dr Paul Sabine of the Riverbank Laboratory (Geneva, Ill.) showed some years ago that with the exception of the largest (hence most cumbersome) types of horns, the hand placed against the edge of the auricle with the concavity forward acts just as well as a collector of sound waves and as a resonator. A few years ago I happened to obtain a few tubes made of copper which were light, easy to carry and gave a tremendous aid to hearing. They were made in England and were rather expensive and difficult to get, but seemed to be the best hearing tubes I have ever known.

With reference to the electrical hearing devices, all otologists realize that there are several defects or disadvantages. They are rather high priced, there is difficulty with batteries, some are heavy and most of them produce annoying adventitious sounds. Some forms of apparatus give best results when there is impairment of conduction apparatus of the middle ear. For involvement of the inner ear or auditory nerve little benefit can be obtained with these electrical devices. I believe that the combination of, first, a careful examination of hearing in order to make an absolute diagnosis so as to formulate the prognosis and to decide which type of hearing device may help, second, selecting such apparatus in a most careful and judicious manner, and third, having the patient study lip reading as soon and as intensively as possible should mitigate in a considerable measure at least the distressing disabilities of the unfortunate hard of hearing.

Correspondence

"A NEW OPERATING ATTACHMENT FOR CATHETERIZING THE EUSTACHIAN TUBE"

To the Editor —In the October, 1929 issue of the ARCHIVES there appeared an article "A New Operating Attachment for Catheterizing the Eustachian Tube," by Robert M. Colbert of New York. He describes this as a new device which was developed with the assistance of Mr. Reinhold H. Wappler. The principle of this attachment does not differ from ones outlined to Mr. Reinhold H. Wappler in 1926, a description of which has appeared in several publications, including my own communication in the December, 1928 issue of the ARCHIVES OF OTOLARYNGOLOGY. Dr. Colbert, in his article, claims priority in the development of a combined instrument for catheterizing the eustachian tube under direct vision. This instrument consists of a cannula which can be attached to a nasal pharyngoscope. He states that the instrument was developed by him through the aid of Mr. Wappler during the period of 1921-1923. I have not been able to find in the literature a description of any sort of such a combined instrument for catheterizing the eustachian tube under direct vision prior to my own publication in 1926 (accepted for publication, Feb. 27, 1926). In 1927, I received a communication from Mr. Reinhold H. Wappler, which read as follows: "We are informed that your catheterizing contraption is inoperative and the specialist who so informs us has designed an improved attachment."

LOUIS K. PITMAN, M.D., New York

Abstracts from Current Literature

Ear

MORTALITY OF CHRONIC MASTOIDITIS M BIGLER, *Ztschr f Laryng, Rhin* **18**-213 (June) 1929

Bigler describes the case history of a man, aged 59, in whom complications of a simple chronic mastoiditis proved fatal. When he first came to the clinic, he was vigorous and seemed healthy, except for the chronic condition of the ear, which had developed after an attack of measles when he was a child. However, a discharge was noted from his ear, and he had ozena. After treatment with boric acid for three weeks, the condition of the ear was greatly relieved. The flow of pus was inhibited, and his hearing improved. From his nasal secretion a vaccine was prepared, which was injected subcutaneously. Three years later, the patient returned to the clinic, complaining that his ear was again suppurating, treatment for a period of from three to four weeks relieved the condition. Six weeks later, however, he again returned, suffering from the previous trouble. Microscopic examination of the pus disclosed pneumococci. His general condition was good, and he continued with his work, being given ambulatory treatment. Within two weeks, however, he complained for the first time of neuralgiform pain over the left temporal bone. Roentgen examination showed that the inner ear was intact on both sides. In the left processus mastoideus, however, a circumscribed dense area was seen, in which the meshlike structure was indistinguishable and a sclerotic cortex was noted. The leukocyte count was 9,000 per cubic centimeter with deviation toward the left. The patient refused surgical intervention and returned home. His condition became rapidly worse, and two days later he was brought to the clinic almost in coma. Operation showed an exceedingly thick cortex. The small cellular spaces of the processus mastoideus were filled with pus, likewise the apex. The antrum was small and narrow and was filled with granulations containing pus. Puncture of the sinus disclosed blood. On the tegmen antri, a large abscess with destruction of bone was noted. The dura was discolored over the region of the temporal lobe. The tympanic cavity was filled with pus and granulation tissue. The patient died the next day. Meningitis had obviously been caused by the retention of pus due to the closing of the narrow antrum with granulations. On the basis of his experience in this case and a review of the literature, Bigler points out that aside from the condition of the tympanic membrane in simple chronic suppurations from the middle ear, the state of pneumatosis in the processus mastoideus and the result of bacteriologic examination must be considered in prognosis of the disease.

Pharynx

INDICATIONS FOR AND TECHNIC OF TONSILLECTOMY J PORAS, *Ztschr f Laryng Rhin* **18** 82 (March) 1929

According to Poras, whose personal experience within the last few years covers more than 1,800 tonsillectomies, none of which had an unfavorable outcome, the tonsils are not of vital importance, and they can be removed at any time without danger to the patient. He states that the tendency toward sore throats is a sufficient indication for their complete surgical removal. The preferred type of operation in children is according to Sluder's method, in adults, tonsillectomy is advised with a blunt raspator. For the purpose of checking venous bleeding, the use of a hemostatic drug is advised, given locally by insufflation, subcutaneously or by intravenous injection. Arterial hemorrhage is stopped by ligature around the vessel. For alleviating the pain caused by the wound, tampons soaked with antiviral are allowed to remain for a short while in the wound cavity, they have proved most efficacious. If the operation is done on account of sepsis or a sug-

gestion of sepsis, a favorable result can be expected only if not more than one or two chills have occurred and if ligation of the jugular vein is done coincident with the tonsillectomy. Care should be taken that the ligature is made as far down as possible below the phlebotic portion of the vessel, in this case, only operation may save the patient's life. Otherwise the prognosis is almost invariably serious.

COMPLICATIONS FOLLOWING TONSILLECTOMY H. CLAUS, *Folia Oto-Laryngol* **19** 89 (Nov.) 1929

From the consideration of thirteen cases reported within the last two years, in nine of which death occurred, Claus points to the danger of infection. In many cases it may be due to penetration of the infected tonsil and the still healthy muscular tissue with the same needle on injection for local anesthesia, thus creating a new focus of infection. Claus also considers operation in an acute stage of tonsillitis dangerous and advises that a period of four weeks be allowed to pass before tonsillectomy. In case symptoms of general infection are noted, immediate tonsillar mediastinotomy should be done, together with injection of vaccine. Ligation of the veins should go hand in hand with drainage of the connective tissue. Two patients in whom these interventions were done could be saved.

Nose

INCIDENCE OF NASAL POLYPS IN OZENA O. HIRSCH, *Monatschr. f. Ohrenh.* **63** 605 (June) 1929

On the basis of a review of the literature and his own experience in forty-two cases, Hirsch says that most polyps do not arise in the middle nasal duct as has been believed heretofore, but that their origin is usually in the accessory sinuses. They are not connected with purulent discharge from the nose, but their origin may be traced to catarrhal inflammation. Recurrence may be explained by the fact that this condition does not change as rapidly as has been believed and that partial incarceration of the mucosa and extension of the inflammation into this region stimulate the formation of a new polyp. The maxillary sinus rather than the ethmoidal sinus is the site of predilection of polyps, according to Hirsch.

RELATION BETWEEN NOSE AND SEXUALITY CORRELATIVE FUNCTION OF NASAL MUCOSA N. KARPOW, *Monatschr. f. Ohrenh.* **63** 758 (July) 1929

On the basis of his clinical experience, a review of the literature and animal experiment, Karpow states, that pathologic processes in the nose are not to be called "local" ones only, but that they react on the entire organism. He points out that many gynecologists have noted the relation between the genital organs and the nose. Of especial interest is the therapeutic effect of cocaine applied to the nose in disorders of the genital tract. The results of forty experiments on rabbits, guinea-pigs and dogs showed that extirpation of the inferior conchae in young animals causes deficient development of the genital tract. He was able to perform resection of each side when the operation was done in two times. In weak concentration aqueous extract of the inferior or middle conchae of a guinea-pig stimulates contraction and causes increase of muscle tonus in the isolated uterine horns of the same animal, a more concentrated solution induces tetanic contraction of this organ. The action of the extract is intensified in the uterus of pregnant animals or those which had already been pregnant. Extract of the mucosa, bone or muscular tissue from any other part of the nose does not have any effect. The result of these experiments convinces Karpow that the tissue of the conchae (especially of the inferior one) contains a substance which has a specific action on the "nerve-muscle" system of the uterus. Whether this action is effective in the living organism, its mode of transmission or the nature of this substance are problems of further investigation.

CONTRIBUTION TO THE PHYSIOLOGY OF TONSIL T. MURATA, *Ztschr f Laryng, Rhin* 18 70 (March) 1929

Murata discusses the relation between the tonsils and the adjacent lymph glands and ducts. On the basis of his experiments on twenty-seven patients made by injection of india ink before tonsillectomy for studying the defense mechanism against penetration of corpuscular elements into the tonsils and a review of the literature, he draws the following conclusions. India ink spread evenly over the surface of the tonsils does not penetrate into the stroma. Neither does it do so if injected into the capsule or the surrounding tissue. It may be found in the excretory lymph ducts. India ink injected into the subepithelial layer of the tonsils usually remains around the site of injection. Small amounts, however, penetrate into the center within the lymphoid tissue and the follicular connective tissue, and in rare instances it can be seen in the epithelium. Murata states that injected into the tonsillar tissue, india ink is spread diffusely and with almost equal distribution in the lymphoid tissue and connective tissue within the tonsil. However, it then drains toward the periphery in a netlike manner and is increasingly absorbed by the cells. There may be a resistance against penetration of foreign bodies between follicle and diffuse lymphoid tissue and between lymphoid tissue and interfollicular connective tissue or epithelium. The india ink present in the epithelium forms circumvallate heaps of small or larger granules.

COCAINE-EPINEPHRINE CORYZA AS THERAPY H. STERNBERG, *Ztschr f Laryng, Rhin* 18 103 (March) 1929

Sternberg points out that disorders in the normal permeability of the mucous membrane of the respiratory tract (and also the ears) are responsible for many diseases. A decrease of this permeability in inflammation and likewise vasomotor diseases of the mucosa of the nose and accessory sinuses cause local disturbances (such as headache and obstruction of the nose) and lead to general disorders. Although Sternberg is against the artificial production of coryza by painting of the mucous membrane with cocaine-epinephrine solution in vasomotor disorders with or without headache, he considers inflammations of the tissue (decreased permeability with all accompanying conditions) as demonstrating the value of the treatment. The cocaine-epinephrine coryza initiates a decrease of swelling (dehydration) of the nasal mucosa and that of the accessory sinuses. Thus with the increased excretion of fluid the toxins and products of decomposition from the mucous membrane are washed out, and the patient is relieved from headache and nasal obstruction.

SUBMUCOUS HIGH RESECTION OF NASAL SEPTUM K. TAKAHASHI, *Folia Oto-Laryngol* 19 22 (Nov) 1929

Takahashi gives a full description of the technic he has developed and applied successfully during the last seventeen years, for restoring normal conditions in pathologic nasal cavities. The entire operation consists of three main parts: first a plastic operation of the lower nasal conchae, then reduction of the lateral nasal wall and, lastly, the submucous high resection of the nasal septum. For these methods he also devised certain instruments. The main advantages of the last-mentioned operation lie in the rapidity (from two to three minutes) with which it can be done and in the preservation, to a great extent, of the mucous membrane of the septum through the use of the entire handle of Takahashi's straight elevators during detachment. In less than 1 per cent of 2,400 submucous resections, tearing of the mucous membrane occurred. Sinking of the bridge of the nose is prevented by beginning the resection from 4 to 5 mm beyond its front part. A subsequent operation, done with this technic on a septum which has remained bent after the first operation, gives the same favorable result. Takahashi reports that in about 10 per cent of his cases, he also resected the tuberculum septi so as to restore normal ventilation. The complete removal of all glandular tissue with knife and cutting forceps leads to rapid healing and favors the permanent result thus obtained.

CONTRIBUTION TO SURGERY OF THE HYPOPHYSIS A. BLUMENTHAL, *Folia Oto-Laryngol* 19 40 (Nov) 1929

In Blumenthal's patient, a man, aged 55, a diagnosis of disease of the hypophysis had been made six years previously. Acromegalia, hypogenitalism, polydipsia and polyuria were present, also bitemporal hemianopia with atrophy of the optic nerve. Roentgenography showed a widening of the sella turcica and flexion of the processus clinoides. The condition had become worse and it was decided to relieve the intracranial tension by surgical intervention. Ten days before the operation, ligation of the carotid artery on the right side was done to prevent extensive bleeding. General anesthesia with tribromethanol was given and was supported by local anesthesia with procaine hydrochloride. A vertical incision was made near the median line of the nose, separating the tissue from the root of the nose to about the apertura piriformis. A second incision was made from the top of the first one toward the middle part of the infra-orbital border. The underlying bone was resected, thus opening medially the frontal sinus and the right maxillary sinus. The right middle and upper part of the right inferior turbinates were also resected, likewise the ethmoid bone with the lamina papyracea. A tampon was placed in the nose, but there was little bleeding. The operative field was illuminated by means of a reflector. It was seen that the roof of the sphenoid sinus was destroyed by atrophy and from its upper part, pus flowed out. Tamponade was done and a permanent tampon laid in the nose. Symptoms of severe cerebral irritation were present, but no signs of meningitis. The skin wound healed as did the interior of the nose. Postoperative treatment with roentgen and radium irradiation was given. The patient's general condition was considerably improved, although vision of the right eye had further decreased, due to the atrophy of the optic nerve.

SIMPLE AND EFFICIENT METHOD FOR TREATING OZENA H. HEERMANN, *Folia Oto-Laryngol* 19 50 (Nov) 1929

The aim in the treatment for ozena, according to Heermann, is to apply a method which exerts effective irritation and can be applied by the patient himself, also one which has no harmful after-effects or in any way disturbs the patient. The old method of treatment by irrigation is still valid, although useless for severe cases. Heermann reports that for the period of one and one-half years he has applied successfully a method of treatment by congestion. Within this time only thirty-two severe cases had been noted, whereas formerly up to 9,200 cases were observed each year. Heermann uses a glass tube with a balloon-like widening, to which a rubber balloon is attached at a right angle. The latter has a diameter of about 6 cm and exerts a pressure of from 50 to 160 mm of mercury. This treatment is first given by the physician at 50 mm pressure, till the patient has become accustomed to the suction. If the uvula cannot be closed, this may be done with help of a spatula by an assistant. Treatment should be given till the patient has learned to breathe by mouth without the uvula opening and his saying "tick-tick." In some patients this may be done after one or two sessions, in others after ten or more sessions. The patient should then learn to hold the glass tube to one nostril and close the other, the rubber ball may be pumped with the free hand. This treatment is advised daily for from ten to fifteen minutes while reading the newspaper. Heermann points out that permanent improvement does not persist, but that the treatment does not propose to be curative. He also advises this method in treatment for dry persistent nasopharyngeal catarrh and severe autophony.

Society Transactions

AMERICAN OTOLOGICAL SOCIETY

ROBERT SONNENSCHN, M D, *Reporter*

Sixty-Second Annual Session, Atlantic City, N J, May 22, 23 and 24, 1929

J GORDON WILSON, M D, *President, in the Chair*

Friday Morning Session, May 24, 1929

(Concluded from p 710)

OTOLOGIC COMPLICATIONS OF SWIMMING IN SUMMER CAMPS DR FRÉDERICK T HILL, Waterville, Me

An individual study was made of 1,235 students from fourteen selected camps. They were all carefully studied at the beginning of the season. Those giving histories or showing any evidence of ear, nose or throat trouble, such as might predispose to otologic complications (36.5 per cent of the total), were grouped according to the presenting pathologic process, and restrictions based on their clinical pictures were imposed on water activities. One and twenty-nine hundredths per cent of the students had chronic suppurative otitis media and sinusitis and were advised against any immersion in the water, 11.17 per cent were placed under partial restrictions, depending on the conditions. The remaining 24 per cent were not restricted, but were carefully watched by the camp physicians and instructed as to behavior in the water. These students were followed during the summer and a careful check-up was made at the close of the season. No complications were encountered from the first group. There were two cases of acute otitis media from each of the last two groups, a much lower incidence than in any previous years, and a total absence of any serious cases. There were also five cases of acute eustachian salpingitis. Practically all of these cases resulted from swimming while the student was afflicted with head colds, the greatest source of ear trouble at these camps. The bacterial content of the water was studied but was not found significant. Camp routine seemed to take care of the extrinsic factors mentioned by Taylor. All types of swimming were practiced, but it was all under careful supervision, especially as to proper breathing. The elimination or restriction of the hazardous cases showing pathologic changes or infection greatly reduced the incidence of complications.

DISCUSSION

DR THOMAS J HARRIS, New York. I have had the privilege of looking over Dr Hill's paper, and I want to speak in praise of the painstaking investigation that he has conducted. His study of more than 1,300 cases cannot help being fruitful in its results. He speaks of the relation of bathing to aural and sinus complications, and this is important. I think that in this paper Dr Hill has drawn attention to some of the important economic aspects of this specialty. Dr Fenton and Dr Taylor have given us the results of their studies for a number of years, and they point out the fact that these complications can occur in fresh running water in which bacteria presumably are absent. The element of fatigue has been emphasized. I want to agree heartily with this point. I think that one hour is a long time to allow boys and girls to stay in the water. Another point that Fenton stressed in his observations is that we should consider the nasal and sinus complications as well as the aural disease that may be present. When there is a latent sinusitis this may be lighted up by a good deal of bathing.

Latent bacteria in the nose become active as a result of the bathing, and a latent sinusitis may become an active condition. The association with the ear is evident. I have been impressed with the added risk of abnormal conditions in the nose. To illustrate, a deflected septum is a potential factor in causing sinus disease, and is a menace in bathing. What Dr. Hill said about acute rhinitis being a contraindication for bathing is true. I can agree with what Dr. Hill said about diving, only I do not think that he made it strong enough. I prohibit diving, except for one straight dive on entering the water. Out of Dr. Hill's paper as a whole there is one chief conclusion to be drawn, and that is the great benefit of a careful study of the nose, throat and ear of all patients and the preventive measures that should be and are being taken by camp physicians in the elimination of potential risks. Dr. Hill has had only four cases of otorrhea during the summer. That is a magnificent showing. If we can get camps to recognize this and see the necessity of preventing economic loss, the excellent results which he has presented may be more generally secured.

DR J. HOLINGER, Chicago. I heartily coincide with Dr. Hill's views and believe that this society should take a stand in regard to two or three points. It seems to me that it is in the line of prevention of deafness to make it known that diving is dangerous to the ears and even to life. The public and even many physicians do not know how quickly a person becomes unconscious when cold water enters the ears. Dr. Hill's propaganda is timely. Another point concerns the method of swimming. The present instruction tends to keep the head too much submerged. Perhaps one cannot swim as fast, but more safely, with the head out of water. The constant effort against the water forces the air out of the canal and water takes its place. A third and important point is that in the presence of a slight cold one should keep out of the water altogether as regards both swimming and the tub bath. True, one feels clearer after a bath for an hour or two, but later on the cold becomes worse and lasts much longer. Writers have called attention to this fact in a number of papers. Any form of hydrotherapy is contraindicated during the presence of a cold.

DR S. MACCUEEN SMITH, Philadelphia. Most of us have been called on from time to time to advise whether children should be allowed to swim. Most of the patients who develop aural disease do so by diving, so I feel that this part of swimming should be limited to those with normal ears and even then the organ of hearing should be protected in the usual way. Most young children are well satisfied if they are allowed to put on their bathing suits, play in the sand, have the benefit of both air and sun and just before leaving the beach go into the water without wetting their heads. Unquestionably, much infection is found in the various swimming pools, notwithstanding that every effort is made to keep them clean and as free as possible from bacterial invasion. I served on a committee of investigation a few years ago and although the water was changed frequently and in some pools run continuously, the children had "colds," became ill and with about the usual frequency had involvement of the ear. I believe that the length of time the children stayed in the pools (and this applies also to bathing in lakes and at the seashore) had much to do with their illnesses and the complications resulting therefrom, from the fact that they became more or less exhausted and this lowered their resistance and recuperative powers. The various rubber devices to keep water out of the ears have been unsatisfactory to both adults and children. The object is better attained by smearing a small plug of cotton with petrolatum, placing this in each ear and then wearing a close cap. The truth of the matter is that the vast majority of cases of aural involvement occur from the attempt of the bather to clear his nose of water, thereby blowing infection through the tube into the tympanic cavity.

DR J. GORDON WILSON, Chicago. I should like to ask Dr. Hill what plug he thinks is most efficacious.

DR D. HAROLD WALKER, Boston. I think that this is a most timely subject. This is the season when summer camps in New England are in full swing. It is an institution which has come to stay. The children go to camp to learn

to swim, and they do not care for camp life unless they are allowed to swim, so that we must give the question of swimming our careful attention. Personally, I believe that every person should learn to swim. I should not be here myself if not for the fact that my daughters have life-saving medals and were able to put their swimming to the test. Dr Hill spoke of the bacterial content of the water, he mentioned 1,650 per cubic centimeter, that is very high. I think that in a case like that there should be an investigation, to determine the type of bacteria. The Maine Lakes have clean water. I was struck by the mention of prior operations on the tonsils. It shows how much more carefully this work should be done. Fifty per cent of poor results is much too high. I think that in giving advice to our patients we should go into details as to how to prevent water from entering the ear. Often in cases in which a child has had a dry ear for a long time, he goes to the beach, and after bathing comes back with a discharging ear. We should show our patients how to use the rubber ear plugs, or petrolatum cotton, with a rubber cap over the head. I think that the time a child is allowed to swim is important. One hour of swimming is fatiguing. It is the only sport in which the body is suspended in a medium without support, and consequently calls for more muscular effort than we realize. I think that if the time were cut down to a half hour twice daily the result would be much better. I think that the question of diving is important. I had one patient, a young man, who dived off a float. He burst his ear drum, became dizzy and when in the water lost his power of orientation. Finally he touched bottom and was guided to the shore. It was hours before he got home. He had suffered a bad rupture from the periphery to the umbo. I have often wondered if accidents of this kind may be a factor in cases of so-called cramps which so often occur in wonderful swimmers. In regard to cases of acute meningitis, I have seen one case of death which occurred after the person dived from a high float. The person caught cold, developed sinusitis and then meningitis. Diving is a dangerous sport. Swimming is necessary, but diving is not.

DR F T HILL. I heartily agree with what has been said about diving. I feel that the observation made by Dr Fenton that many cases of death in the water, so-called cramps, are due to a labyrinthine stimulation is undoubtedly correct. I was talking to a swimming instructor at one of the camps, and while he did not know anything about the labyrinth, he was much opposed to the form of swimming in which the head is submerged, and to plunging for distance. This work was taken up in selected camps and we had pretty good cooperation, but in one camp not in this list in which there was no regular medical supervision we had ten times as much complication. Diving is a menace, but camp authorities will not stand for too much restriction. The same thing applies to fatigue. These youngsters are usually in the pink of condition, able to hike several miles a day and will not tolerate having their swimming time curtailed. The average time in camps is an hour, but they sometimes have two half hour periods. In one lake in which there was a high bacterial content, there was decayed vegetable matter, but no *B coli* were found. A fungus growth appeared for the first time last year. These youngsters are often hard to handle and want to go into the water whether they have colds or not. The danger I think is in the prodromal stage. The danger Dr Holinger spoke of may be minimized I think if the children are carefully supervised and taught to breathe properly when swimming. The question of fatigue is important. People will go to a swimming pool to swim after a hard day's work. This adds fatigue to the risk. As regards plugs, cotton moistened with petrolatum or hydrous wool fat is preferable. Rubber plugs might irritate the canal.

THE USE OF THE NEW MAGNESIUM ALLOY FORKS DR ROBERT SONNENSCHIEIN, Chicago

Although many appliances have been devised for use in functional testing of hearing, tuning forks still remain in many ways the best, most dependable and easily accessible instruments. Unnickled forks tend to rust on exposure to the

air or handling with moist fingers. Nickeled forks sooner or later give rise to adventitious sounds when the nickeling peels. A complete series of forks, from C-2 (16 double vibrations) to c-5 (4,096 double vibrations), has been perfected by Mr. B. E. Eisenhour of the Riverbank Laboratory, Geneva, Ill., of an alloy consisting of 95.6 per cent magnesium (which has a specific gravity of 1.7), 0.4 per cent manganese (having a specific gravity of 8) and 4 per cent aluminum, with a specific gravity of about 2.7. The alloy, therefore, has a specific gravity of about 2.2, in other words, about one-third that of steel, which is usually 7.7. This metal has two great advantages, first, that it is rust proof and secondly, that it is light in weight. In testing the lower pitches, the hands soon tire because of the great weight of the low pitched steel forks, especially those that are provided with weights. The price of these forks is a little less than that of the best German forks, such as the Edelmann series. They do not seem to be any more brittle when properly handled, as all good forks should be.

These forks can be supplied with the "constant" of decrement or dampening, and may thus be used for determining the loss of hearing figured in sensation units just as is done with the audiometer.

Magnesium forks, just like the medium and low pitched steel forks, have decided overtones when struck, but these may be eliminated by the use of weights as is done with steel forks, or by placing about the ends of the prongs thin but fairly wide bands of rubber.

The highest pitched, c-5 (4,096 double vibrations), magnesium alloy fork does not vibrate long enough for all purposes, but the other forks of the series do well for testing both air and bone conduction. When one simply desires to see whether the patient can hear the tone of c-5, the magnesium fork serves well, but not if one wishes to test actual duration of hearing for this pitch.

Whether the new magnesium alloy forks will ultimately largely displace steel forks in otologic practice cannot be positively stated at present, for it will require considerable experience on the part of many otologists to settle this question definitely especially with reference to the highest tone, c-5 (4,096 double vibrations). It seems, however, that we have here a satisfactory solution of the problem of supplying forks made of a metal which is rustproof, and the weight of which is such that long-continued testing does not prove as fatiguing as it does with the heavy steel forks. Hence these new forks have some decided and desirable advantages to their credit.

DISCUSSION

DR. G. E. SHAMBAUGH, Chicago. One point has come up in this discussion and that is the question of the duration of the vibration of the fork. I prefer a fork that dies out slowly. I do not see the disadvantage in the prolongation of the sound. In applying the Rinne test I get a more accurate division and can distinguish better between bone and air conduction. You can note by the duration whether the sound is heard before the ear or behind it.

DR. MACFARLAN, Philadelphia. I appreciate being asked to speak before the Otological Society, chiefly because I am interested in forks and the possibility that we will still hang onto the forks. I am enthusiastic about audiometers too, but I do not see how we can discard forks. I agree in the main with Dr. Sonnenschein, because long experience with forks has brought about recognition of facts that are irrefutable. The committee has done good work in getting the Riverbank Laboratory to work on the production of a fork that is light and useful, especially when one has to test all morning. This fork is more desirable than the foreign forks, and I am glad that it is an American product. I do not believe that Dr. Sonnenschein brought out the importance of the matter of time. I am less concerned about the matter of pitch than Dr. Sonnenschein. It does not matter to me whether my forks are 256 or 240. I know the general region in which I am testing. Dr. Fowler developed the fact that there were no sharp dips in the auditory perimetry. The standardized fork manufactured by the Standard Instrument Company (the one in which Dr. Mackenzie was interested) was standardized to a very exact pitch. We have no difficulty with the continuous range audiometers in determining

the pitch of the fork. If my steel forks get rusted, I have to renickel them to get the same pitch, but I do not mind if they get a little higher or lower, as long as the hearing time, fifty-five or forty seconds, is the same, because if not, it would alter my record keeping. When I hit the forks with a pendulum blow the standard time is the same. That gives a standard hearing time, fifty-five seconds for air and thirty seconds for bone, which is the normal hearing. In regard to the overtone, fortunately that is not as strong as the fundamental, but Dr. Sonnenschein is right in being on the lookout for the reporting of that tone instead of the fundamental tone of the fork. If you make the patient sing the note he hears you can tell whether or not it is the overtone. As to the overtones caused by rust, they are so minute, so transient, that they are of no importance. Rubber bands will give out overtones, but any dampening whether by weights or by bands will not alter workable time. One should allow an interval between testing air conduction and bone conduction. This can be done with a fork that vibrates for one hundred and fifty seconds. The standard Mackenzie forks vibrate for two minutes. That takes too long to make the tests. The Alexander forks are 110 air conduction and 70 bone conduction but when making a series of tests 60 air conduction and 50 bone conduction is long enough. This gives a faster working time. Another point about the long time fork is that one is apt to get tone images. This should be avoided, but in children and in adults who have been deaf for a long time one is not apt to get tone images. There is another point about long time forks, that they die out at the end very slowly. Short time forks die out very suddenly. The big low tone forks run a long time with a short vibration stimulus. In regard to the tactile sense, there is confusion in the mind as to whether the patient is reporting tactile sense or hearing, and for this reason I do not use the low tone, or the high fork, but employ the audiometer for the high pitches. In the middle zone of hearing the forks between 300 and 3,000 double vibrations are the forks which give the most useful results in testing. The measurement is by using a standardized blow. The weight of the forks shown by Dr. Sonnenschein is most desirable. I think that Dr. Sonnenschein's work with the Riverbank Laboratory has given us something we can thank him for and we ought to be grateful to him for persuading us to hold on to the forks.

DR. C. C. BUNCH, Baltimore. I am glad to see one thing in the new forks which is a real drawback in the Bezold-Edelmann forks. I have had graduate students working with a set of forks that I was compelled to use. With some of the larger forks, in order to secure a loud tone, it was necessary to strike the fork with considerable force. The result was that the set screws on some of the forks were bent and broken. To secure repairs was expensive and necessitated cutting the threads with a lathe equipped with gears arranged for metric units. In these new forks the set screw is part of the weight so that it is not possible to break the thumb screw when unskilled people are using the forks. Secondly, the low tone forks, especially the 16, make very faint sounds. I think that we could make the prong larger to get an increased area of vibration. Some of the earlier reports on hearing have been deficient. It has been said that there was a clinical significance in the raising of the low tone limit, but if the low tones were made loud enough they could be heard in many cases. It is a distinct advantage to have a fork light enough that it can be handled with the two fingers and thumb. The Bezold forks are very heavy.

DR. A. G. POHLMAN, Buffalo. I agree with both Dr. Sonnenschein and Dr. MacFarlan. Forks have a useful place in testing. All of my quantitative measurements of bone transmission are made with a bone activating receiver with an oscillometer that fits into the manipulator. It is always difficult to plot the lower frequencies. In regard to overtones, I use the 256 and the 512 double vibrations fork. In regard to pressure, both bone and air sounds are affected by plus and minus pressures in the ear canal. I should like to ask Dr. Sonnenschein if the laboratory has perfected a method of striking a standard blow. A trip device was designed to give the fork a standard period of vibration. This was graded

to activate the fork for two or three intensities by a spreader mechanism, so that the fork would be self-activating. This device was for the Lucae type of fork.

DR ROBERT SONNENSCHN. Dr MacFarlan is, I believe, absolutely correct in his assertion. It is true that a slight amount of rusting will not apparently change the pitch of the fork and it does not make a great deal of difference in testing whether there are 254 or 256 double vibrations. I have always felt that accuracy and uniformity are essential qualities in experimental investigation. We cannot very well compare results unless conditions under which tests are made are uniform. It does not perhaps make so great a difference whether the forks rust or not so far as testing is concerned, but it does make them look unsightly. As for the vibrations of the loose pieces of nickel, even though they may not seriously interfere, why have them if you can avoid them? Another matter is that the re-nickeling is rather expensive. Our point was simply this: that the Committee of the American Academy of Ophthalmology and Otolaryngology (consisting of Dr Gill, Dr Mackenzie, Dr Dean and myself) has endeavored ever since it was appointed in 1921 to educate otologists, especially in the smaller communities, to make the standard tests in a uniform manner. We tried to get forks at a fairly reasonable price. The method of exciting a fork with a pendulum gives uniform results if the pendulum swings through an arc of 90 degrees, the force of the gravity thus being the same each time. I have used a pleximeter which fell through an arc of 90 degrees but I realize that a pendulum is better in many ways, and I have at times used the one that was presented to me by Dr MacFarlan. So far as the rubber band placed around the prongs is concerned, this does not materially interfere with the duration of the vibration of the fork, but it does have a desirable effect in cutting out the overtones. So far as tone image is concerned, patients do have a memory of tone and therefore it is much better to approach the individual from a distance in testing with a watch, accumulator, voice or otherwise, and to note at which point he first begins to hear the sound. When a fork vibrates for a very long time, the patient has difficulty in knowing when the sound stops. With the low tones, from 16 to 128 double vibrations, the idea is principally to know what the low limit is. We do not as a rule test the duration of the hearing for these forks. We desire to know the lowest tone at which the patient begins to hear by air conduction. With reference to Dr Shambaugh's remarks about the Rinne test, it often shortens and makes the test more accurate by simply seeing, as he does, whether hearing by air conduction or bone conduction is the louder. Dr Fowler presented some studies on this question about three years ago at the meeting of the American Laryngological, Rhinological and Otological Society in an effort to determine the ratio of air to bone conduction. When the fork is held firmly against the mastoid we naturally dampen it considerably and diminish the duration of its vibration. Therefore it is often better to strike the fork and press it against the mastoid, and see if the patient hears it, then hold the prongs near the ear, then replace on the mastoid, then before the ear, and so on, until the patient no longer hears by mastoid, and then note how long he still hears it by air conduction. The Rinne test shows the difference between air and bone conduction, and one should remember that simply stating whether the Rinne test is positive or negative is not sufficient. For instance, there are two forms of the positive Rinne test, that is, that air conduction is longer than bone conduction, as in the normal, but in those cases in which the air conduction is longer than bone but both factors are shorter than the normal, there is usually a lesion of the inner ear. Likewise when we state that a Rinne test is negative, meaning thereby that the bone conduction is longer than the air, we should remember that there are several varieties of this, and therefore it is important to know whether the air and bone conduction are considerably shorter than the normal, even though the bone conduction happens to be longer than the air. In the new forks made of the magnesium alloy, we have the great advantage of the absence of rusting, and owing to the extreme lightness in weight the fingers do not tire after doing a number of tests. Furthermore, at the suggestion of Dr Bunch, clamps or weights were devised which did not have projecting parts as in

the Edelmann forks. Some criticism has been made of the fact that the lowest fork, C-2 (16 double vibrations), does not produce very loud tones, but Prof Bentley told me that he was surprised to see what sounds could be obtained from these forks in spite of the noise in the room. In striking these forks, a uniform method should be used.

TRAUMATIC EAR CONDITIONS IN WORKERS UNDER COMPRESSED AIR DR
HARRIS H VAIL, Cincinnati

This article was published in full in the August issue, p 113

DISCUSSION

DR J G DWYER, New York. Twenty-two years ago I performed the autopsy in several fatal cases of caisson disease contracted in the Steinway tunnels in New York and found the condition to be that of nitrogen gas in the tissues, the theory being that the cases were due to liberation of nitrogen due to sudden release of pressure, the same principle as release of pressure in a siphon soda bottle.

The present case (described by Dr Harris) was intensely interesting and along the same lines as Dr Vail's. The point to be emphasized in this case was the intense vertigo produced in contrast to the slight nystagmus. This would suggest that vertigo and nystagmus do not go hand in hand, as is so often thought.

DR THOMAS J HARRIS, New York. This work opens up questions on a subject that deserves to be thoroughly investigated. I hope that Dr Vail will not stop before he is able to give further reports on the internal ear, which are now lacking. The case referred to by Dr Dwyer was most interesting. I have never seen a similar one at the Post-Graduate or the Manhattan Eye and Ear Hospitals. Dr Shambaugh says that such cases can offer interesting data as to what is taking place in the internal ear. The patient was an Irishman, aged 30, newly arrived in this country. The first time he came out of the caisson, he showed marked symptoms of caisson disease. The history was one of intense vertigo, profound deafness and characteristic symptoms of the "bonds." He was subject to spells of weakness in which he fell and almost lost consciousness. By the audiometer there was complete loss of hearing in the other ear. All tests were negative. There was decided lowering of hearing in the other ear. The graph showed a marked drop for the upper tones, 8,192 being lost. The man was given treatment with pilocarpine and improvement of hearing in one ear was noted, but no material benefit was shown in the audiograms. The man was given cold caloric test at 60 degrees and there was no response from either canal. The labyrinth appeared dead. The man was put in the turning chair and there was a most profound reaction. We only turned him twice and the vertigo which followed was so intense that we did not try it again. The nystagmus was very short in either direction. In view of this, can it be possible that we must revise our ideas in relation to the center involved? The conclusion that we arrived at was that the man had suffered from a hemorrhage sufficient to blot out both vestibular and cochlear parts of the labyrinth. In both sides there were probably multiple hemorrhages. I saw the patient in the hospital before I left and he had recovered from his attacks of vertigo, but the interesting point is that from the time he came to the hospital he showed a lowered mental activity. Dr Dwyer thinks that the mental sluggishness has increased, and that he has reached the point of stupor. We must consider whether or not the involvement is extra-labyrinthine.

DR G E SHAMBAUGH, Chicago. Do you recall any evidence of injury to the middle ear?

DR THOMAS J HARRIS. The drums were normal. There was no evidence of injury to the middle ear a few days after the accident.

DR S MACCUEN SMITH, Philadelphia. You spoke of the administration of pilocarpine. Was the drug given hypodermically, or by mouth?

DR THOMAS J HARRIS We felt that the man was entitled to any possible form of treatment. The medicine was given by mouth and consisted of a 2 per cent solution of muriate of pilocarpine, the dose being increased 1 minim, night and morning, until profound sweating took place. Whether or not that had any effect on the slight improvement of hearing we do not know. The vertigo was materially improved, almost disappeared, but his mental condition was still impaired. He had to be brought to the hospital by his niece. The two points of interest are the discrepancy between the rotation and the caloric test, and secondly the mental sluggishness. In regard to pilocarpine, Politzer used it in certain cases of labyrinthine involvement, administering it hypodermically. I should like to have Dr Vail tell us what the medicolegal aspect of these cases is, and whether he has had any experience with this question.

DR S MACCUEEN SMITH It was Politzer who first suggested hypodermic injections of pilocarpine for the treatment for certain labyrinthine diseases. In my experience this line of treatment has been beneficial in a fair number of cases, especially if its administration has been followed by iodine given internally in quickly ascending doses until the physiologic effects have been produced, such as a mild coryza.

DR F T HILL, Waterville, Mo. In 1915, during a period of subway construction, we had some cases at the Manhattan Eye and Ear Infirmary. There were definite symptoms of caisson disease. Some patients have also been seen recently from work on the Canadian border. There is a definite lesion of the middle ear without labyrinthine involvement. In one case there was a mucoid discharge from the nose and hemorrhage from one ear. Sinus infection would be indicated by the discharge from the nose. The condition in this case quieted down rapidly after incision of the membrana tympani, but the patient was sent back into the caisson before the ears were healed. The hearing was very low on the audiometer. I feel that in a case of this kind it should be insisted on that the man does not go back under compressed air until the lesions of the ears are completely healed.

DR GEORGE E SHAMBAUGH, Chicago. This unusually interesting communication by Dr Vail has shown the outstanding feature in regard to the involvement of the ear in caisson disease. (1) There is failure to get a proper equalization of pressure on both sides of the drum membrane, and (2) there is liberation of gas emboli into the circulation with possibility of their lodging in the labyrinthine vessels. In the first case also we may get labyrinthine involvement. This may be common in connection with rupture and injury of the drum membrane. It would be interesting to find out whether increase of the pressure or the liberation of the patient from the pressure is what causes the injury. Both processes might result in traumatism. The patient will recover from a simple tear in the drum membrane, but if there is hemorrhage into the internal ear there will be Meniere's syndrome, with permanent deafness and tinnitus. In regard to the air emboli, I know a case in which a man was in the habit of loosening up the septal membranes by air pressure. In one case the patient developed Meniere's syndrome and the hearing was destroyed in one ear.

I hope that the studies made in this disease will add to the acquisition of knowledge of the physiology of the internal ear. If the facts are kept clearly in mind we may get some interesting sidelights on the function of the internal ear. The labyrinthine artery is a single vessel and if that is plugged all function of the labyrinth is destroyed. On the other hand, minute gas emboli need not block up the whole labyrinthine vessel. The first branch supplies the proximal two thirds of the basal coil and also part of the ampulla. If the lesion is located here the high tones should be lost by audiometer tests. We know how far the artery extends, and a lesion of the basal coil should produce disturbance of tones and also upset the function of the posterior semicircular canal. That might tell something of the function of the posterior semicircular canal. The second branch supplies a definite area, the macule of the saccule, the macule of the utricle, and the ampulla of the posterior and superior semicircular canals. In questions in

which we can exclude involvement of the middle ear we may be able to differentiate between labyrinthine and cochlear involvement. According to the involvement of the vessels of the modiolus, the apex of the cochlea may remain intact. The vessels of the modiolus are in the nature of end-arteries and do not communicate with adjacent blood vessels except by minute branches under the tunnel of Corti. The vessels running along the lamina spiralis ossea supply Corti's organ, and their occlusion would produce a lesion of the organ of Corti. Study of these cases should give insight into the physiology of the organ of Corti.

DR J GORDON WILSON, Chicago. When you did the caloric test, did you put the head back, in other words, was it done on both the superior and the horizontal canals?

DR THOMAS J HARRIS, New York. That question was asked of Dr Dwyer at the meeting at the Academy of Medicine. The caloric test was done in the various positions.

DR ROBERT SONNENSCHN, Chicago. I should like to ask how it is that if there was no reaction to the caloric test with the head in the various positions, there nevertheless was found to be some response of the canals on turning, and this response was equal in the two directions. If the caloric response was gone, how can one explain this phenomenon?

DR T J HARRIS. We did not know how to reconcile the discrepancies. The chief thing was the profound vertigo. It looked as if we would have to revise our views as to the mechanism of nystagmus. We hope to make a further report on this case later on.

DR J GORDON WILSON. We are not justified in saying that all vertigo is of aural or even vestibular origin. The profound vertigo to which Dr Harris refers does not astonish me. The patient showed a markedly affected mentality, and it is characteristic of cerebral disturbances that they give pronounced vertigo. This can be often seen in neurasthenic patients complaining of dizziness. The explanation appears to me to be that in such cases a cerebral influence is lacking preventing the normal inhibitory influence from the cerebrum.

DR ROBERT SONNENSCHN. Alexander would not coincide in that view of nystagmus.

DR J GORDON WILSON. You can get vertigo without nystagmus. It is well exemplified in the dizziness that some people experience on looking down from a height.

DR H H VAIL. The discussion has done what I hoped it would do, namely, to bring out the important aspects of a problem that is a growing one. Undoubtedly there will be many works of construction, and this condition will recur in the future. I am glad that Dr Shambaugh said what he did. There is no report made of examination of the internal ears, and no microscopic study made of the ears or temporal bones in the cases autopsied. That should make us watch for these cases and go after an autopsy. Until you have a final proof you do not know what happened. Dr Dwyer's case was an interesting one, but there are many similar cases reported in the literature. A man was made deaf, blind and speechless by caisson disease. I believe that the only treatment is prompt recompression as soon as symptoms appear. The laws of New York State specify the length of time a man can work under pressure, and give regulations as to decompression and recompression. It is foolish to take patients to the hospital unless there is a recompression tank there. The time to beat the case is when the symptoms first appear. Recovery may then take place as the bubbles of nitrogen are recompressed back into a soluble condition. There is a definite legal aspect to this problem, because most of them are industrial cases. New York State has a definite code and most other states are furnished with New York laws in construction cases, but I think that the construction companies are often cold-blooded, and do not insist on otologic examinations. They should be forced to provide these for the workmen whenever necessary. Otologists should be readily available because the lesions of the ears in caisson workers are serious. The

ear troubles in the two cases I have reported are due to compressed air, and are probably not due to nitrogen bubbles. In regard to Dr Shambaugh's remark about the elevation of the septal mucosa by compressed air in performing submucous resection of the septum, with formation of an embolus, that is entirely different from the embolus in caisson disease. This forms in the spaces in which circulation is poor, such as the spine and joints. The brain usually escapes. Dr Dwyer's case is one of cerebral damage. Sometimes the brain and cerebellum escape, but the spinal cord does not. Often these workmen get into this difficulty from inexperience. In France an aviator came down too quickly and bled from the ears. A few days later mastoid tenderness developed and a mastoid operation was done. The middle ear and mastoid were filled with blood caused by hemorrhage when the patient passed too rapidly from the lower to the higher pressure.

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Secretary-Treasurer Dr J Frank Friesen, 1208 Roosevelt Bldg, Los Angeles
Place California Hospital, assembly room Time 8 p m, first Monday of
each month

THE COLORADO OTO-LARYNGOLOGICAL SOCIETY

President Dr Frank L Dennis, Ferguson Bldg, Colorado Springs
Secretary Dr Rex L Murphy, Metropolitan Bldg, Denver
Place Assembly Room of Metropolitan Bldg, Time First Saturday of each
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* Secretaries of societies are requested to furnish the information necessary
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Secretary Dr Kenneth L Craft, Hume-Mansur Bldg, Indianapolis
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 January and March meetings are devoted to clinical work

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MIXED TUMORS IN THE SOFT PALATE

REPORTS OF TWO CASES AND A SURVEY OF THE RECENT
LITERATURE ~

ROBERT SONNENSCHN, M D
CHICAGO

The so-called "mixed" tumors which occur frequently in the cephalic region have given rise to a good deal of controversy because of the uncertainty regarding their origin. While they may occur in the neck, pharynx, lips, cheek and palate, they are found especially in the salivary glands, and are often generalized under the name of the salivary gland type of mixed tumors. These tumors are characterized by the heterogeneity of the tissues contained in them as well as by a great irregularity in the arrangement of the cells.

Henneke¹ of Leipzig, in 1913, was one of the first to make a detailed study of these tumors, including their histology. Of the 360 cases of mixed tumors of the salivary glands which he found recorded in the literature, 288 were in the parotid region, 69 in the submaxillary region and only 3 in the sublingual gland. Although Henneke referred to mixed tumors occurring elsewhere in the orofacial region he did not include them in his statistics, as his monograph referred only to tumors of the salivary gland. McFarland,² in a fine and comprehensive article, brought the subject down to date in 1926, and added to the existing statistics 90 new cases of tumors of the parotid gland (of which 67 were undoubtedly, and 12 cases probably, mixed tumors). Fry³ recently published the results of a splendid study of 25 mixed tumors of the salivary gland observed in St. Mary's Hospital, London, England from 1912 to 1923 inclusive. In this report he entered extensively into the histology of these growths, 17 of which were in the parotid gland and 5 in the submaxillary, the exact location of the other 3 was unknown.

Most writers agree that such tumors appear with about the same degree of frequency in males and in females and that they may occur

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* Read before the American Laryngological Association, Atlantic City, N. J., May 21, 1929.

1 Henneke, H. Die Geschwulste der Speicheldrüsen. *Ergebn. d. Chir. u. Orthop.* 6: 254, 1913.

2 McFarland, J. Ninety Tumors of the Parotid Region. *Am. J. M. Sc.* 172: 804, 1926.

3 Fry, R. M. The Structure and Origin of the Mixed Tumors of the Salivary Glands. *Brit. J. Surg.* 15: 201, 1927.

at any age. According to McFarland, they have been observed in persons varying in age from 1 to 87 years. Chamberlin⁴ said that they occur most frequently between the twentieth and fortieth year, that they seem to have a preference for the left side, and that they are almost always sessile tumors.

The most important clinical fact connected with these mixed tumors is their long duration and slow development. As a general rule, they exist for many years before the patient consults a physician regarding them. Cases have been reported in which they have been known to exist for thirty, forty, fifty or more years before their growth has become sufficiently accelerated to cause serious trouble to the patient.

The largest mixed tumor of the parotid gland on record appears to have been reported by Conterill⁵ in 1907, it was more than twice the size of the patient's head, weighing 26 pounds (11.8 Kg). Operation was not performed. The largest parotid tumor for which operation was performed weighed 7 pounds (3.1 Kg). Several illustrations of extraordinary mixed tumors of the salivary gland are given in Heineke's monograph.¹

It will be seen from the foregoing comment that there is plenty of both clinical and histologic material available for the study of these tumors.

In this paper I am particularly interested in two mixed tumors of the salivary gland type occurring in the soft palate. Mixed tumors in this particular site are comparatively rare. In an excellent paper recently published, Eggers⁶ stated that a careful search of the literature showed reports of more than 100 mixed tumors occurring in either the hard or the soft palate. Sturgis,⁷ in 1914, recorded a personal case of mixed tumor in the soft palate and collected thirteen other cases reported by McLeod, Cross and Moche, Mauclair and Durieux, Sobileau, Cabourd, Berger, Heron, Swyngdeux, Escat, Guggenheim and Ripault, and Halstead. Some of these cases are omitted from Eggers' list, but he says that the histologic details were absent in some cases, and that he was unable to consult the original reports in some others. About one third of Eggers' 100 cases refer to the soft palate. In the recent literature I find cases apparently not included in Eggers' list, such as those reported by Fry,³ Chamberlin,⁴ Moreau,⁸

4 Chamberlin, W. B. Mixed Tumors of the Salivary Gland Type Occurring in the Soft Palate, *Tr. Am. Laryng., Rhin. & Otol. Soc.*, Sec. **33** 175, 1927.

5 Conterill, Scott M. & S. J. **20** 526, 1907, cited by McFarland (footnote 2).

6 Eggers, H. E. Mixed Tumors of the Palate, *Arch. Path.* **6** 378 (Sept.) 1928.

7 Sturgis, M. G. Mixed Cell Tumors of the Soft Palate, *Surg. Gynec. Obst.* **18** 456, 1914.

8 Moreau, L. Sur une volumineuse tumeur mixte volo-palatine, *Lyon chir.* **17** 721, 1920.

Koch,⁹ Davis¹⁰ and Boyko¹¹ Altogether the number of mixed tumors of the soft palate reported in the literature would appear to be under 50

Chamberlin's case was that of a woman, aged 42 The tumor was in the left anterior pillar and consisted of two masses, 2 by 3 by 5 cm and 1 by 1.5 by 2 cm, respectively, enclosed in a capsule from which they were easily shelled out The pathologist reported a "mixed tumor of the salivary gland type" In Moreau's case the patient was a man, aged 22 The tumor was stated to have contained no epithelial elements, and was histologically described as a lymphendothelioma or a lymphatic perithelioma, according to the German pathologists The author classified it as a (peri-amygdal) mixed tumor of the soft palate

Koch's tumor occurred in a man, aged 57, it was of about forty years' duration, was on the left side and was the size of an apple Boyko's case was in a woman, aged 32, and was located on the right side In Davis' case, a large mixed tumor of the parotid gland was enucleated from the soft palate

The palatal tumors do not differ essentially from mixed tumors of the parotid or other salivary glands, and what is known concerning the origin and structure of the latter may be presumed to be generally true of the former tumors

REPORT OF CASES

CASE 1—A R, aged 29, first seen by me on Nov 4, 1927, complained of having a "lump" in his throat and an external swelling on the right side of his neck The latter had been present for three weeks, but the disturbance in his throat had existed for several years The tonsils had been removed some time before Examination of the nose and nasopharynx gave negative results, except that there was a large right inferior turbinate Inspection of the pharynx revealed a huge, fairly firm, rounded swelling on the right side of the soft palate extending downward toward the tonsil fossa from which the tonsil had previously been removed The larynx and trachea were normal The Wassermann reaction obtained by the National Pathological Laboratory was negative A roentgen examination made by Dr Julius Brams showed no evidence of a pathologic condition in this region The tumor was punctured with a large needle, but no fluid was found The clinical diagnosis was fibroma of the soft palate A few days later, under local anesthesia consisting of nerve blocking of the posterior palatine nerves and also infiltration of the mucosa covering the tumor by means of a 1 per cent solution of apothesine, the tumor was removed An incision was made through the mucosa, then by blunt dissection the growth was removed in one mass The tumor had a smooth capsule, it was nearly globular, with the exception of a few rounded protuberances, which gave the whole structure the appearance of a uterine fibroid The dimensions were about 5 by 6 by 6

⁹ Koch, F. *Wien klin Wchnschr* 40 780 (June 16) 1927

¹⁰ Davis, D. Large Mixed Tumor of the Parotid Enucleated from the Soft Palate *J Laryng & Otol, Soc Proc* 40 390, 1925

¹¹ Boyko, G. V. Mixed Cell Tumor of the Palate, *J A M A* 85 2023 (Dec 26) 1925

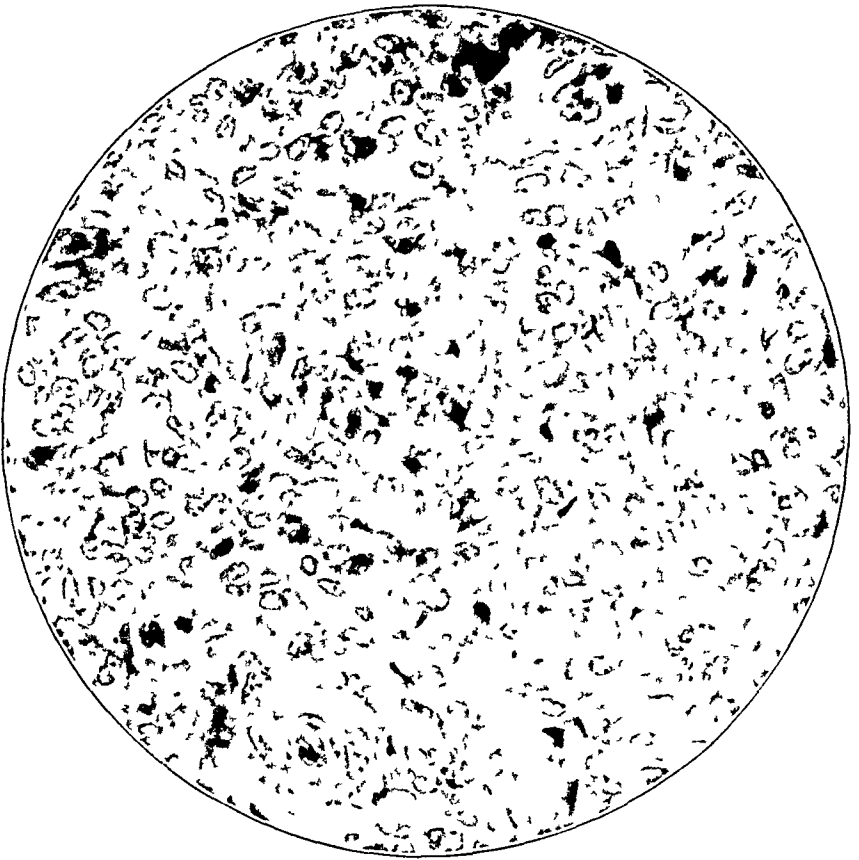


Fig 1 (case 1) —Solid sheets of large pale-staining epithelial cells, with occasional mitotic figures

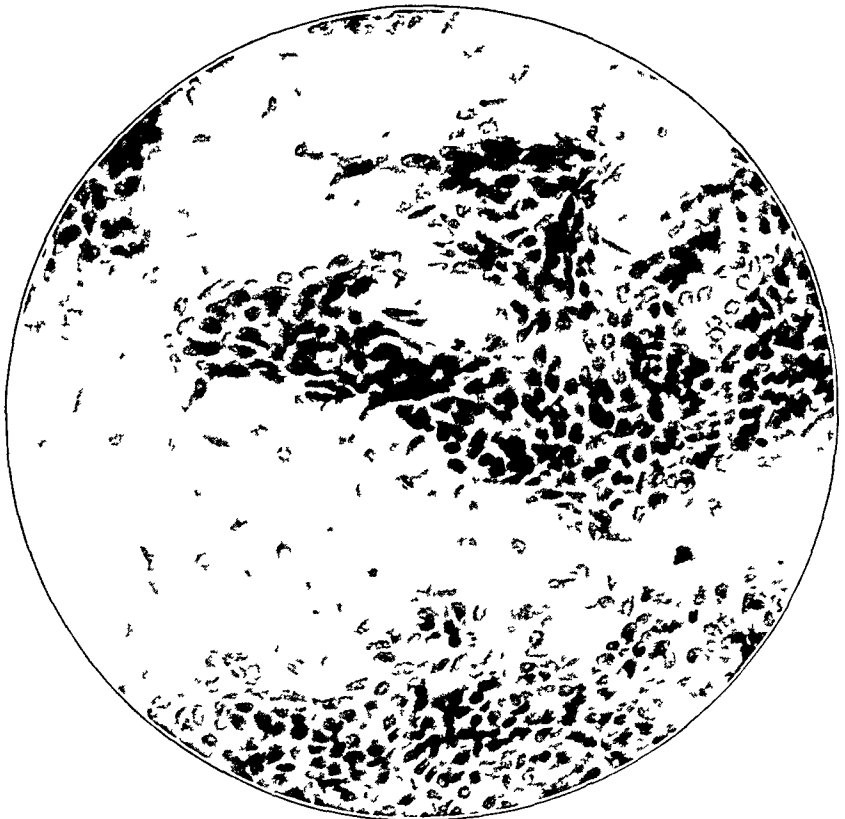


Fig 2 (case 1) —Irregular masses of small deep-staining epithelial cells, resembling nasal cell carcinoma

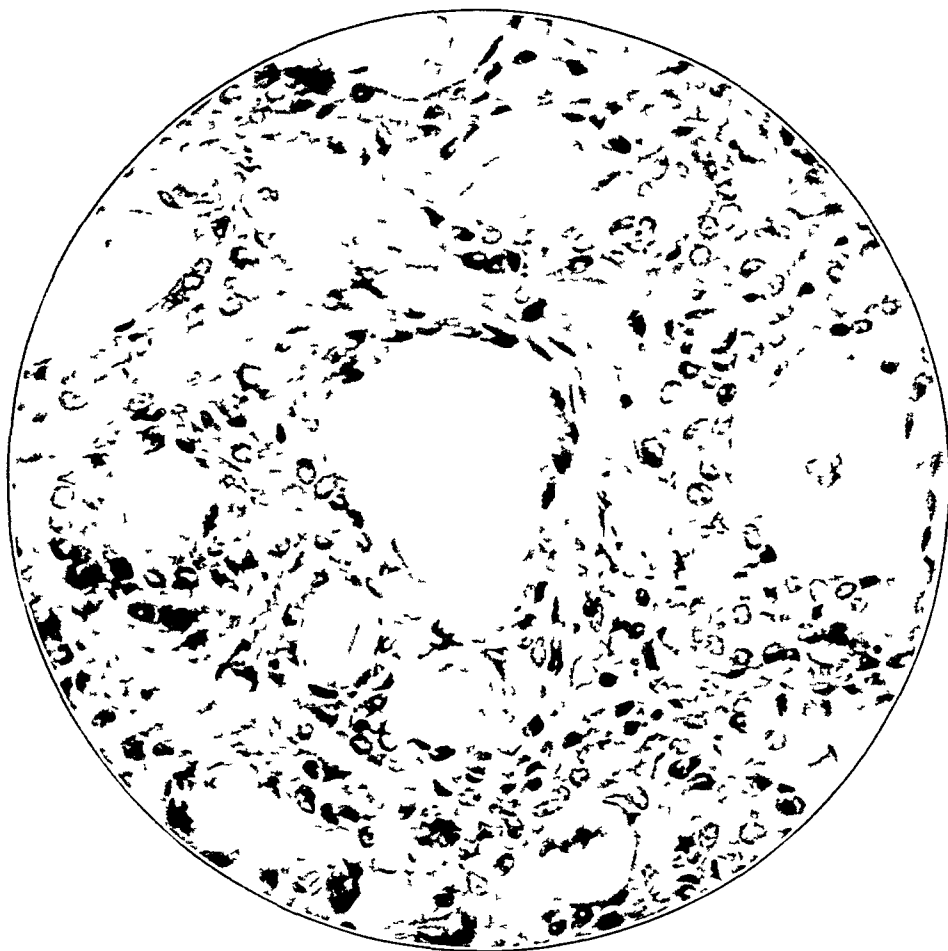


Fig 3 (case 2) —Acini lined by flattened epithelium and having pink-staining homogeneous contents resembling colloid

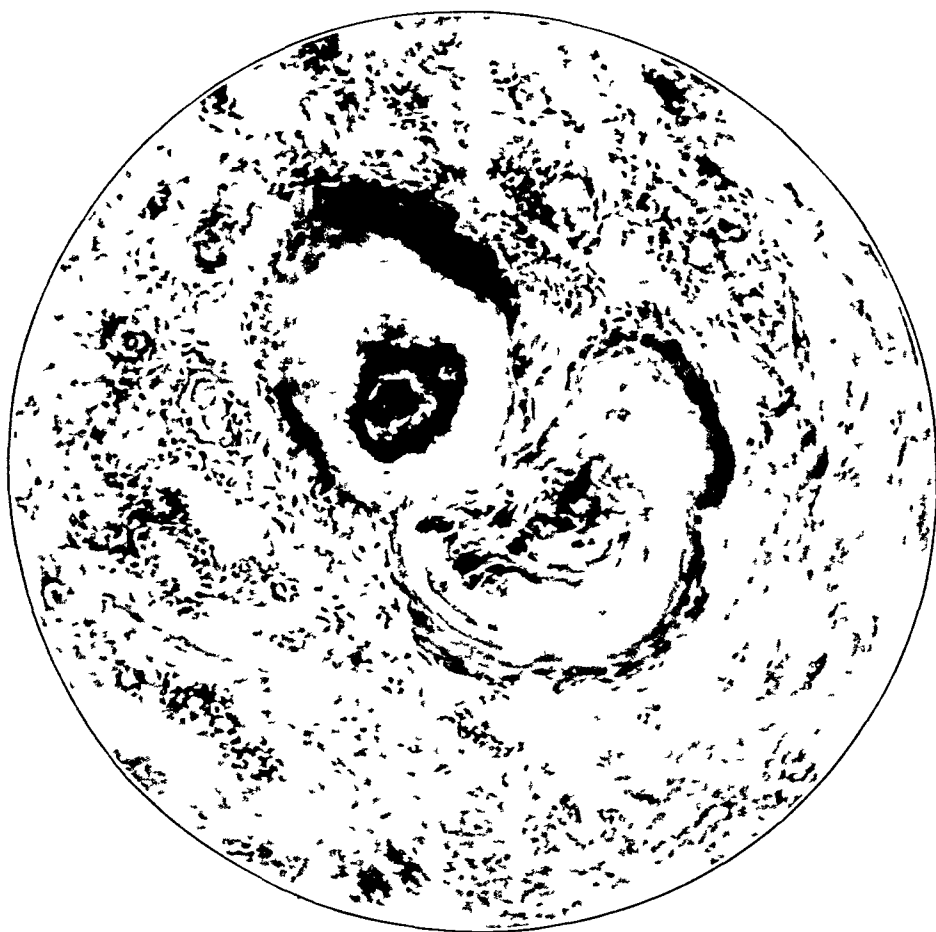


Fig 4 (case 1) —Masses of squamous-celled epithelium with cornification and calcification

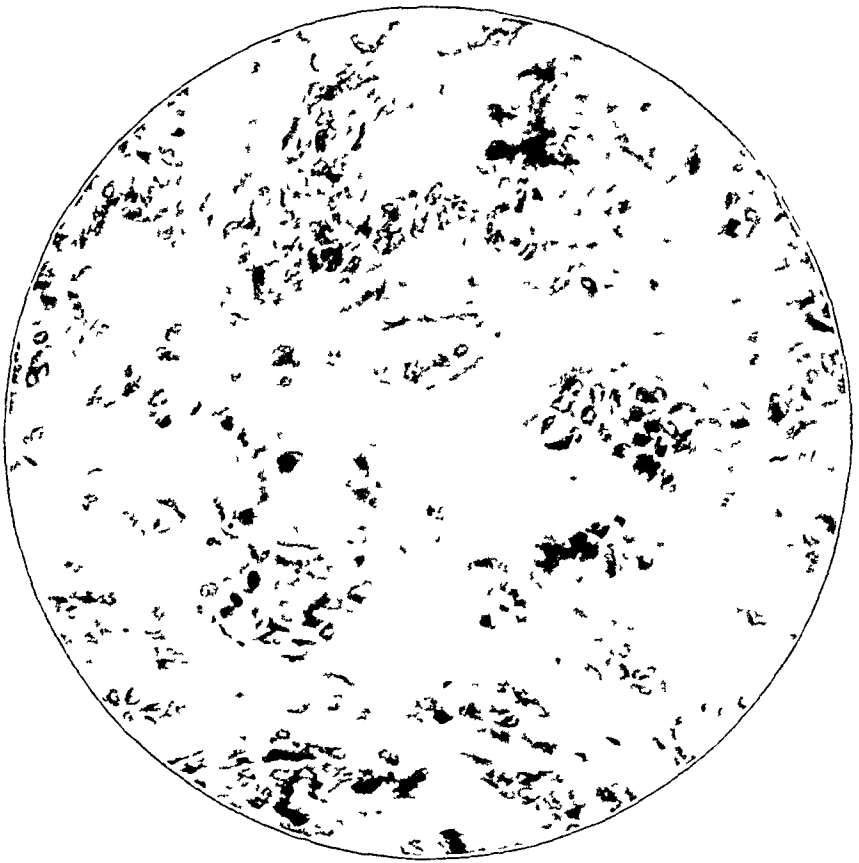


Fig 5 (case 1) —Large epithelial cells arranged in alveoli, separated by wide bands of hyaline stroma

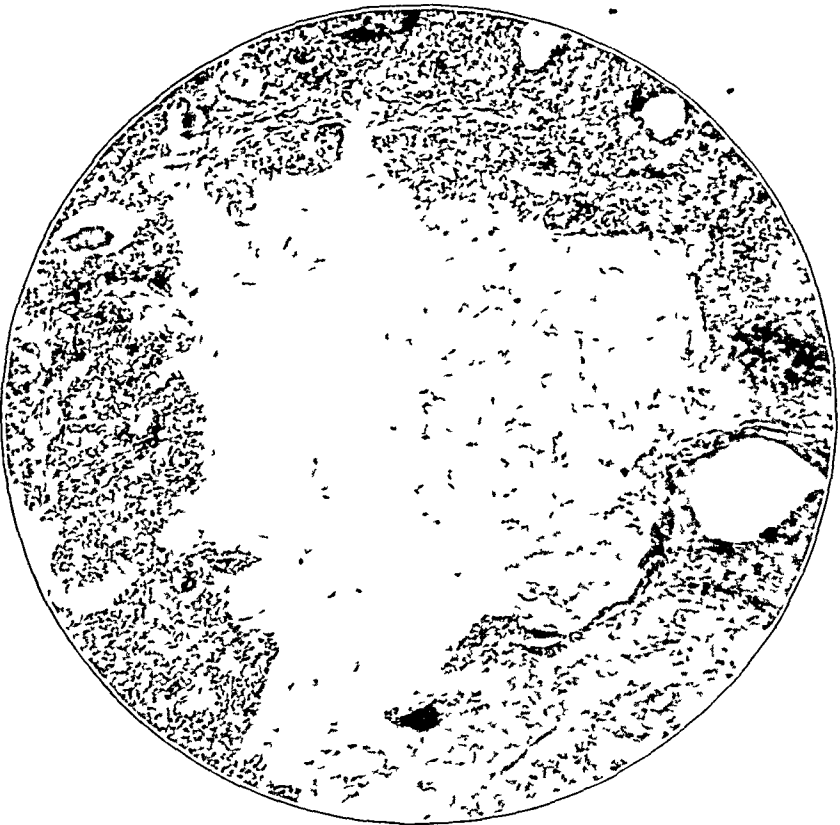


Fig 6 (case 1) —Areas of cartilage, mucoid stroma, basal cell type of epithelium and alveoli

cm The wound, closed with catgut sutures after the insertion of some gauze packing at the lower end of the incision, healed promptly The tissue was fixed in a diluted solution of formaldehyde, U S P (1:10) A histologic examination was made by Dr Ludvig Hektoen and Dr J J Moore of the National Pathological Laboratory

In the microscopic sections were found various arrangements of epithelial cells in solid masses, alveolar formation, strands and columns separated by areas of

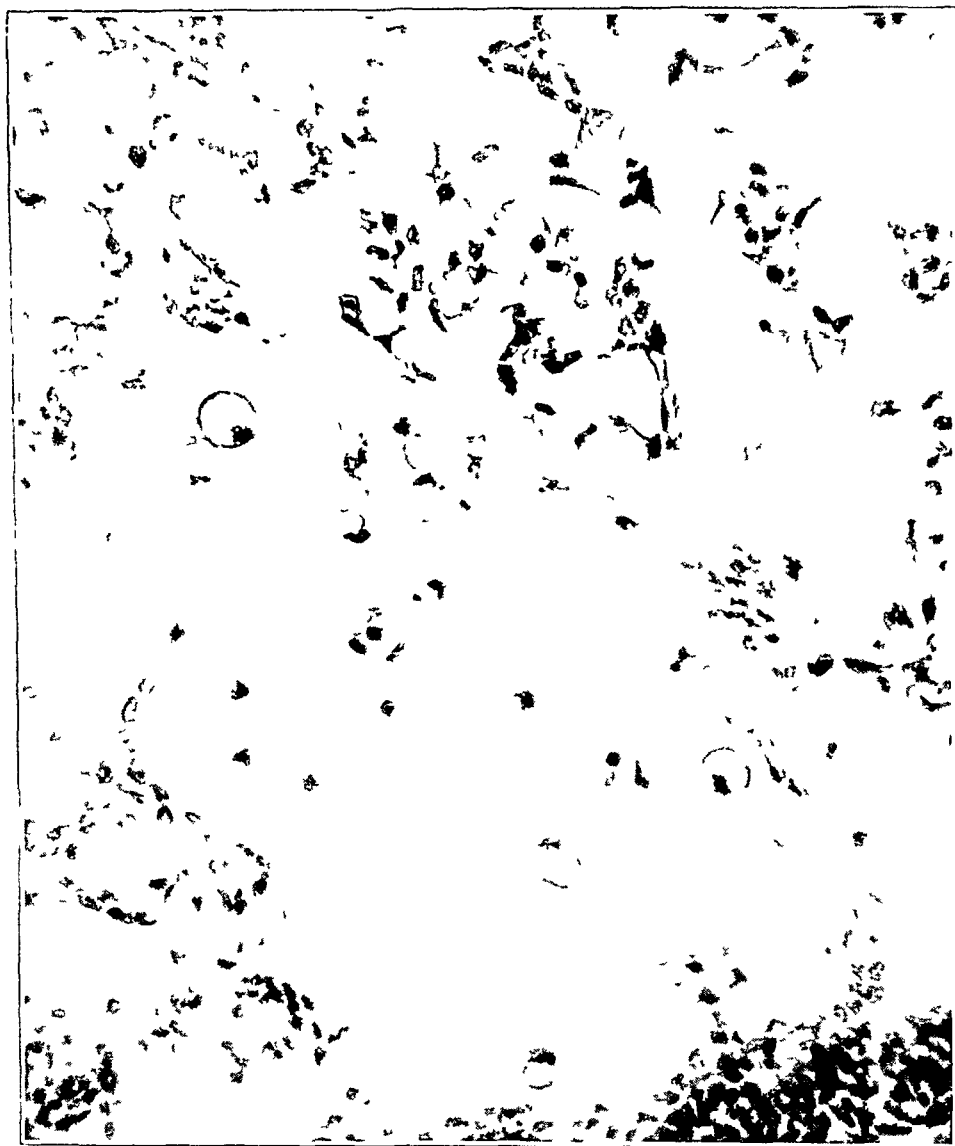


Fig 7 (case 1) —Cartilage and mucoid tissue under higher magnification

connective, mucoid and cartilaginous tissue The epithelial tissue predominated in these slides About one third of the sections consisted of sheets or large solid masses composed of large pale-staining epithelial cells with occasional mitotic figures (fig 1) The next epithelial structures of importance were strands and columns of deep-staining epithelial cells resembling basal cell carcinoma invading mucoid (fig 2) or hyaline stroma A few alveoli were present, filled with a pink-staining substance resembling colloid lined by cuboidal and flattened epithelial cells (fig 3) Squamous epithelial masses with cornification and calcification were infrequently found (fig 4) The stroma consisted of con-

nective tissue, which in places was markedly hyaline, apparently compressing the epithelial strands (fig 5) and mucoid (figs 2 and 6) and cartilaginous areas (figs 6 and 7). Fat cells were present in small groups but were not common. Blood vessels were not a prominent feature. They showed no relation to the epithelial cells. The growth was a mixed tumor of the salivary gland type and was classified as a myxochondrocarcinoma.

The patient was last observed about ten months after operation, at which time the pharynx, soft palate and pillars seemed normal except for the long scar. Recent attempts to get in contact with him failed because of change of residence.

CASE 2—Dr S. J. Pearlman, who performed the operation, has permitted me to report this case. Unfortunately the history is rather meager. It concerns a man, aged 29, who had no symptoms, although the growth had been present for several years. It was discovered accidentally on examination of the throat. The tumor was the size of an ordinary marble (about three fourths of an inch in diameter), and was situated in the right side of the soft palate. It was removed, together with its capsule, under local anesthesia. Nothing further could be learned of the patient.

A histologic examination was made by Dr J. J. Moore. The section submitted for examination consisted chiefly of mesothelial elements including connective tissue, hyaline connective tissue and large areas of cartilage. In and between there were bands of large light-staining epithelial cells and many alveoli lined by cuboidal and flatter epithelial cells (fig 3) and containing acidophilic-staining homogeneous material suggesting colloid. No collections of the small basal type of epithelial cell or of pearly formation were found. The histologic picture was that of a mixed tumor of the salivary gland type, which fell within the myxochondrocarcinoma group.

TISSUES IN MIXED TUMORS

According to McFarland,² the following tissues may be found in mixed tumors of the salivary glands of the neck (since they are of the same nature, all such tissues may occur in mixed tumors of the palate)

Connective tissues

- Cartilage of varying type
- Mucous tissue of varying type
- Fibrillar connective tissue
- Bone (rare)
- Adipose tissue (very rare)
- Muscle tissue (very rare)
- Lymphoid tissue (very rare)

Epithelial tissues

- Glandular epithelium, almost always
- Squamous epithelium, in the majority of cases

Several or possibly all of these tissues may be found in every mixed tumor of the kind under discussion. In the first case which I report in this paper, a number of these tissues occurred. It is perhaps this heterogeneous collection of tissues which has aroused the great interest of histologists as well as of clinicians, and which is the basis for the fairly large literature which has sprung up regarding them.

Eggers analyzed 92 mixed tumors of the hard and soft palate on the basis of them containing some or all of the four tissues most often found in mixed tumors in general, i. e., mucoid connective tissue, and cartilage, glandular and squamous epithelium. Twelve of the tumors showed the presence of all four tissues, in 70 there was mucoid tissue, in 35 cartilage, in 84 epithelial glandular tissue and in 32 squamous epithelial tissue. The great majority of the tumors showed the absence of one or more kinds of tissue. The other elements of less frequent occurrence (fatty tissue, muscle and bone) were not considered.

ORIGIN AND STRUCTURE OF MIXED TUMORS

When these growths were first examined microscopically, the German pathologists regarded them as connective tissue tumors. When epithelial tissue was observed, it was considered as arising from embryonic "rests" of the gland in which the tumor occurred. French pathologists generally regarded the tumors as of epithelial origin and as derived from the glandular tissue proper. Depending on the view adopted by them, other writers described the growths as endotheliomas, epitheliomas, sarcomas, etc. In order to gain some idea of the mode of occurrence of the various tissues in mixed tumors, one must consider the theories that have been advanced by different investigators with reference to their origin.

A summary of these views, as given by Fry, is as follows:

- 1 The endothelial theory (Volkmann's) held that the tumors were derived from the endothelium of the lymph vessels. This theory has been gradually discarded because mixed tumors of the salivary gland type do not in many respects conform to the characteristics of endotheliomas.

- 2 The embryonic theory was that the tumors are derived from pluripotential cells which have ceased to develop further at different stages of embryonal development, and which have later given rise to neoplasms.

- 3 The branchial theory was developed largely to explain the presence of cartilage.

- 4 The theory of origin from embryonic gland germs has never received great support. It is necessary to assume either that the "rests" consist of both ectodermal and mesodermal elements, or else that the connective tissue is derived by metaplasia from the epithelium.

- 5 On the theory of origin from fully formed glandular tissue (which Fry states is becoming more and more adopted), the tumors are supposed to be derived from adult gland cells. Fraser,¹² who dis-

¹² Fraser, A. Mixed Tumors of the Salivary Glands, Surg. Gynec. Obst. 27: 19, 1918.

cussed this question after comparing the growths with the effects of ligation of the parotid duct in dogs, came to the conclusion that the tumors arise entirely from the cells of the ducts, and that the cartilage is formed from the epithelial elements by metaplasia

With reference to the microscopic aspects of the various tissues, Fy³ gives a complete histologic account of a typical mixed tumor of the salivary gland in which he said that for descriptive purposes only two main types of tissues need to be considered, namely (1) those parts of the tumor in which the cells are abundant, lying closely packed together, with the stroma scanty or nonexistent, and (2) those parts in which there is much stroma and the cellular elements are widely scattered, lying singly or in small groups

Fy's detailed observations are as follows

(In the first type) where there is much parenchyma and little stroma, the cells (being tightly packed together) show very indefinite outlines. In most places they merge into one another, giving the appearance of a syncytium, but occasionally their outlines can be distinguished, and they are then generally polyhedral, cubical or low columnar. Their nuclei are almost invariably large, and round or oval, showing very distinct nuclear markings, and often a well-marked nucleolus. The cytoplasm shows no special characteristics

(In the second type) where there is an abundant stroma, the cells undergo great changes in appearance. The nuclei generally lose their regular shape and clear markings, and become irregular in shape, variable in size and stain uniformly deeply with hematoxylin. The cells themselves tend to become triangular or spindle-shaped and the cytoplasm appears to extend out from the corners of those irregular cells in fine processes which blend imperceptibly with the stroma

The stroma itself consists of two parts. Firstly, there is a network of fine fibrillar connective tissue running between the cells and groups of cells. This provides support for the cells, and also carries the very limited number of vessels which supply the tumor. These vessels, few in number, are generally very thin-walled, often consisting of merely an endothelial lining. They are present in small quantities in the more cellular parts of the tumor, but are often practically absent from the less cellular parts. In these parts the connective tissue stroma is practically nonexistent too, and it is here that the second element of the stroma comes into prominence—a substance closely resembling mucin. Whether it is pure mucin is difficult to say, but microscopically it is indistinguishable from mucin and stains well, often intensely, with mucicarmine. This substance varies in its appearance, in places having a definite fibrillar structure when it stains most intensely with mucicarmine and in other places being quite homogeneous in appearance not unlike the matrix of cartilage. In those parts the staining reaction is not so well marked. There are intermediate stages between these extremes and all forms may be present in the same tumor clearly representing different stages in a biochemical change which is taking place

This mucinous material should not strictly be regarded as stroma as in its origin and nature it is quite distinct from the stroma proper, but it is described as such purely for convenience in the account of these tumors

Finally, in these less cellular parts, especially where the mucinous stroma is homogeneous, the cells occasionally have a special relationship to the stroma lying apparently free inside small circular vacuoles, in the stroma. Round the periphery

of these vacuoles, there is usually some condensation of the mucinous material leading to a more deeply stained ring in the mucicarmine preparation, and the whole appearance is scarcely distinguishable from a section of cartilage stained by the same method

The arrangement of the cells varies in different parts of the tumor, but Fry stated that these variations may be grouped under four headings

1 Irregular masses of cells of varying size, in which the cells are closely applied to each other without any definite arrangement

2 Cells in adenomatous arrangement In these parts the cells show a definite tendency to imitate glandular forms, and occasionally nearly perfect reproductions of salivary ducts may be found

3 Alveolar formation In such places alveoli of varying sizes are found Many of these may be formed by the dilatation of the ductlike structures mentioned These alveoli are sometimes empty, sometimes they contain a homogeneous material which stains intensely with eosin or picric acid, and at other times they contain mucin

4 Rarely a type of tissue is met with which at first sight appears to consist of interlacing double columns of cells which have split down the middle of the column On examination of many sections, however, it is found that this appearance is produced by papilliferous ingrowths into dilated alveoli or by the irregular compression of alveoli

On the basis of this study of twenty-five mixed tumors of the salivary gland type, Fry came to the conclusion that the tumor cells are derived from the secreting cells of the gland In regard to the cartilage, he said that "it would appear that in the tumors of this series, cartilage does not exist There is in many places a tissue closely resembling cartilage, but the cells in it are epithelial cells derived from the other epithelial cells of the tumor and the matrix is a degenerative product of the mucin which is formed by an exaggeration of the normal function of the epithelial cells" He stated further that the so-called mixed tumors of the salivary gland type are not really mixed, but are entirely epithelial in origin The mucinous material, which is such a prominent feature of most of these tumors, is a true secretion of mucin by the tumor cells

The view that the epithelial cells underwent a mucoid degeneration and subsequent chemical transformation into cartilage was first put forward by Erich¹³ in 1906

McFarland stated that if the mixed tumors are inclusions (enclavoma) and originate in sequestered and isolated embryonal material, the varying miscellany of tissues explains itself through the number and

¹³ Erich, E Zur Kenntniss der Speicheldrumentumoren, Beitr z klin Chir 51 368, 1906

character of the originally sequestered materials. Antecedents of all the different tissues were found present in the rudiment or primordium from which the tumor grew.

Eggers, who made a close histologic study of five personally collected tumors of the mixed type occurring in the palate (in four of these the tumor was unquestionably typical) and also reviewed the literature of mixed tumors of the salivary gland type, came to the conclusion that the theory of embryonal displacement would account most satisfactorily for these tumors, if it were not for the fact that occasionally they show a gradual mergence into normal glandular structure, and that usually they show an intimate blending of parenchymatous epithelium and stroma to the point that it is not possible to determine where one ends and the other begins. To explain the apparent transition from epithelial to connective tissue there was advanced the theory of actual metaplasia of epithelium into mucoid connective tissue or cartilage. Many writers now believe that these mixed tumors occurring in the salivary glands may be derived by metaplastic processes involving the development of the neoplastic epithelium of the tumor. In the case of palatal tumors, according to Eggers, a similar process is postulated from the mucous glands of this region. In all five palatal mixed tumors investigated by Eggers there was an infiltrative growth of the epithelial elements, and in all except one there was an apparent merging of epithelium into stroma.

The mixed tumor of the palatal gland, according to Eggers, shows a somewhat lower incidence of cartilage and a higher incidence of squamous stratified epithelium than tumor of the salivary gland. This could be explained, if the theory of displacement is correct, as the later embryonic development of the palate. However, the clinical and histologic evidence is not decisive.

From the various opinions cited, it would appear that there is still doubt and disagreement regarding the exact origin of mixed tumors of the salivary gland type, but it seems that there is at least some tendency to accept the occurrence of the so-called cartilage as the result of a metaplastic process.

BENIGNANCY OR MALIGNANCY OF MIXED TUMORS

The question of the benignancy or the possible malignant degeneration of mixed tumors of the type described is of importance in connection with prognosis.

Wood,¹⁴ in 1904, expressed the opinion that about 25 per cent of mixed tumors of the face and neck showed malignant degeneration.

¹⁴ Wood, F. C. Mixed Tumors of the Salivary Glands, *Ann Surg* **39** 57, 1904.

Fry stated that some of these tumors show varying degrees of malignancy, but that there is no definite dividing line between the benign and the malignant tumors.

McFarland was more definite. He expressed the opinion that mixed tumors of the salivary gland type are inherently benign, an opinion that was also held by Hemeke. They commonly recur, however, after excision (he found a 25 per cent recurrence in his own series), and if frequently disturbed, become locally destructive without showing metastases. He found only one fairly definite case of sarcomatous change in seventy-five supposedly mixed tumors. From his study he also concluded that there is little evidence either in the clinical data or in the literature, to support the idea of the carcinomatous degeneration of mixed tumors or that at least the occurrence is rare. According to McFarland's view, the rapid enlargement of a mixed tumor of long duration and slow growth is not the result of malignant change, an interval of ten, twenty or thirty years may elapse between the operative removal of a mixed tumor of this type and its recurrence. Nothing of a prognostic nature can be deduced from a microscopic study, but the structure and duration of the tumor must both be taken into account in the formulation of a prognosis.

Eggers said that in palatal tumors malignancy is of far rarer occurrence than in mixed tumors of the salivary glands. In only two of the ninety-two cases of this kind of tumor the histories of which he examined, were there instances of invasive or recurrent growth. He further said that it is the general opinion that mixed tumors of the parotid gland become malignant only when they escape from their capsule. Palatal tumors, however, usually cause more discomfort than tumors of the salivary gland. Because of this fact as well as of their being more readily recognized they are more likely to receive surgical treatment early, and thus escape from any tendency to a malignant termination. "It must be emphasized, however, that from the morphologic point of view alone, practically all of the palatal tumors would be adjudged as malignant, from the clinical point of view, almost none."

Treatment in cases of mixed tumors is surgical removal except for those which are inoperable because of intimate relation to large blood vessels or for some other reason. When surgical intervention is contraindicated, roentgen treatment is said to be efficacious.

CONCLUSIONS

- 1 Mixed tumors involving the soft palate are rare.
- 2 Their exact origin is not definitely known, some authors believing that they are entirely epithelial and others that they are the result of 'enclavement' or accidental sequestration of embryonal cells during the early and complicated development of the base of the neck.

3 These tumors are probably individual entities having no relation to the normal structures in which they occur and from which they do not arise

5 While they are apparently benign, they often recur after removal, if frequently disturbed, they may become locally destructive even though they produce no metastases

6 When histologically examined, they may show an apparently malignant character, although clinical history usually shows the contrary. In other words, the prognosis should be determined from the history of the case and not from the histologic observations

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UNILATERAL ABSENCE OF SIGMOID SINUS

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The sigmoid portion of the transverse sinus, although varying in position and in size in different mastoid processes, is, to be sure, a constant observation in temporal bones. The complete absence of this sinus, as shown in the following case report, is of interest not only because of its rarity, but because it serves to bring up the question of the embryology of the venous blood channels in the cranial cavity.

REPORT OF CASE

While dissecting a "head and neck" in the First Anatomical Institute of Vienna, Dr. Milton Golfen and I came across the following anomaly.

The specimen was that of a man, aged 35, showing no apparent external deformity. After we had removed the brain and dura, our attention was directed to the disparity in size between the two petrous bones and the complete absence of a sigmoid sinus on the right side. Unfortunately, the dura had already been destroyed, and we were unable to trace the exact distribution of the sinuses between its layers.

On the left side the sulci for the sinuses showed a normal arrangement (fig. 1), except that the sulcus of the left sigmoid sinus was larger and more excavated than normally.

On the abnormal right side (fig. 2), there was a scarcely noticeable, shallow depression leading from the confluens sinuum, as the horizontal portion of the sinus transversus, but after extending for a distance of 7 cm, it curved rather abruptly downward and entered a large foramen for the mastoid emissary vein, just behind the mastoid process. When the emissarium was probed from its opening on the external surface of the temporal bone, behind the mastoid process, it was felt as a large channel extending downward and medially into its opening on the internal surface. Anterior to the emissarium opening on the inner surface, the continuation of the transverse sinus (sigmoid portion) was entirely lacking for a distance of 4.5 cm. The right jugular foramen was very narrow compared with its fellow of the opposite side. The right inferior petrosal sinus was well developed and was the only vessel emptying into the small right internal jugular vein, which measured only 2 mm in diameter. A right jugular bulb was lacking. The groove for the right superior petrosal sinus was completely absent, the two surfaces of the petrous pyramid meeting at a sharp angle. Compared with the petrous bone of the opposite side, the right was unusually infantile and underdeveloped. Viewed from the posterior surface, the superior (frontal) and inferior (sagittal) semicircular canals were prominent, the opening for the aqueductus vestibuli was superficial, while the lateral half of this surface formed a large, deep excavation. Viewed through transmitted light, the transparency of this surface was readily seen.

* Submitted for publication, Aug. 13, 1929.



Fig 1—Left temporal bone, showing large sulcus for sigmoid sinus *EA* indicates the eminentia arcuata, *IAM*, the internal auditory meatus, and *SS*, the sulcus for the sigmoid sinus



Fig 2—Right temporal bone, showing complete absence of sulci for the sigmoid and superior petrosal sinuses Note the infantile character of the petrous pyramid with a prominent arcuate eminence, a subarcuate fossa and a convexity for the sagittal semicircular canal as well as the superficial opening for the vestibular aqueduct *AV* indicates the aqueductus vestibuli, *EA*, the eminentia arcuata, *IAM*, the internal auditory meatus, *MF*, the mastoid foramen, *SC*, the sagittal semicircular canal, *SF*, the subarcuate fossa The portion from *X* to *X* shows the complete absence of a sulcus for the sigmoid sinus

REVIEW OF THE LITERATURE

A perusal of the literature revealed the fact that otologists have scarcely been aware of the existence of temporal bones lacking sigmoid sinuses, although anatomists occasionally have found such specimens. Thus in the Museum of the Anatomical Institute of Vienna, Professor Hochstetter showed me one such specimen. Hofmann,¹ in 1924, reported a case of high-grade underdevelopment of the left sinus sigmoideus and internal jugular vein, and reviewed the literature. The specimen in his case, although resembling the specimen described, differed from the latter in that it still possessed narrow channels for the sigmoid and superior petrosal sinuses, and did not show any evidence of underdevelopment of the petrous bone.

Barkow,² quoted by Hofmann, reported a case in which there was a large right jugular foramen, a much smaller jugular foramen on the left and a sigmoid fossa on the left ending in an unusually large mastoid foramen, whereas for a stretch of 20.9 mm. between the mastoid foramen and the left jugular fossa, the sigmoid sinus was entirely lacking.

Zuckerkandl, Buhe, Tervait, Henle, Rohrbach and Linser, as quoted by Hofmann, reported other anomalies in the course and situation of the transverse sinus.

Professor Alexander, on being shown the specimen described, offered his invaluable aid and interest in the matter. He also lent me three temporal bones from his collection for study, which were presented to him by Dr. Alexander Korozy of his clinic, and which showed another type of anomaly. A description of this type of abnormality will help to explain the factors involved in the development of the venous sinuses of the dura mater. Professor Hochstetter also showed me specimens and models portraying the embryonic state of the venous channels in the skulls of animals.

Two of the temporal bones referred to are a pair from the skull of a child, aged 1 year, and, together with a third from that of an adult, show the same type of anomaly, i. e., the persistence of the so-called sinus petrosquamosus. Commencing from the upper end of the sulcus sigmoideus, this emissary-like vessel communicated with the surface veins of the head by forming a deep groove in the temporal bone in the angle between the squamous and the petrous portions, leaving the skull through the so-called foramen jugulare spurium of Luschka, under the lower edge of the root of the zygomatic bone. The sigmoid sinus was present in these specimens (fig. 3).

1 Hofmann, L. Ein Fall von hochgradiger Unterentwicklung des linken Sinus sigmoideus und der Vena jugularis interna, *Monatschr. f. Ohrenh.* **59** 406, 1924.

2 Barkow. Anat. Abhandl., Breslau, 1858, cited by Hofmann.

To understand properly the origin of the anomalies mentioned, a study of the embryologic development of the venous blood channels inside the cranial cavity is essential. Salzer³ studied the development of the blood vessels in the brain of different mammals, and Streeter,⁴ in 1915, showed in a striking manner their mode of development in the human embryo, Markowski,⁵ in 1922, further contributed to the latter study.

The arrangement of the primitive venous drainage of the brain consists of capillaries surrounding the brain tube and emptying into the anterior cardinal vein which enters the heart. These capillaries drain into three plexuses which have three stems—anterior, middle and posterior—which unite to form the "primary head vein" in the region of the midbrain. The primary head vein consists of an anterior portion medial to the gasserian ganglion and a posterior portion lateral to the otic vesicle and the seventh, eighth, ninth, tenth and eleventh cranial nerves.

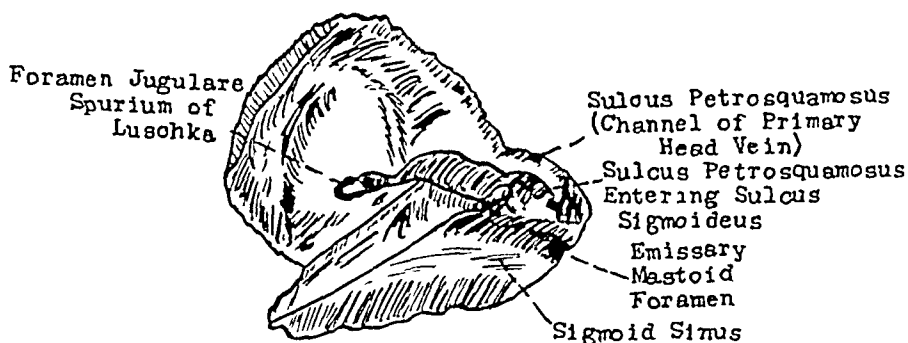


Fig 3—Sketch of infant's temporal bone, showing decadent channel of primary head vein

According to Hochstetter,⁶ this vein in *Echidna* forms now the chief stream for the venous blood of the anterior division of the brain. It leaves the skull capsule in a bony canal not far from that for the facial nerve, and after leaving this canal unites with the anterior cardinal vein.

In all other mammals further changes arise whereby an anastomosis is formed above and medial to the otic vesicle, between the stems from the middle and posterior plexuses, so that now a part of the venous blood of the brain leaves the skull through the jugular foramen, and

3 Salzer, H. Ueber die Entwicklung der Kopfvenen des Meerschweinchens, *Morphol Jahrb* **23** 232, 1895

4 Streeter, G. L. The Development of the Venous Sinuses of the Dura Mater in the Human Embryo, *Am J Anat* **18** 145 (Sept) 1915

5 Markowski, J. Entwicklung der Sinus durae matris und der Hirnvenen des Menschen, *Bull internat Acad Polonaise d Sc et d Lettres*, Cracow, Imprimer de L'Universite, 1922

6 Hochstetter, in Hertwig. *Handbuch d Entwicklungslehre der Wirbeltiers*, vol 3, no 2, p 147

another part through the venous channel referred to. This condition persists in *Omithorhynchus*. In other mammals (including man) the primitive part of the primary head vein normally becomes obliterated, the later portion formed by the anastomosis persisting. A study of the diagrams in figures 4 and 5 will make clear the aforementioned anastomosis.

By uniting with their fellows of the opposite side, the conjoined anterior and middle plexuses of one side become the superior and

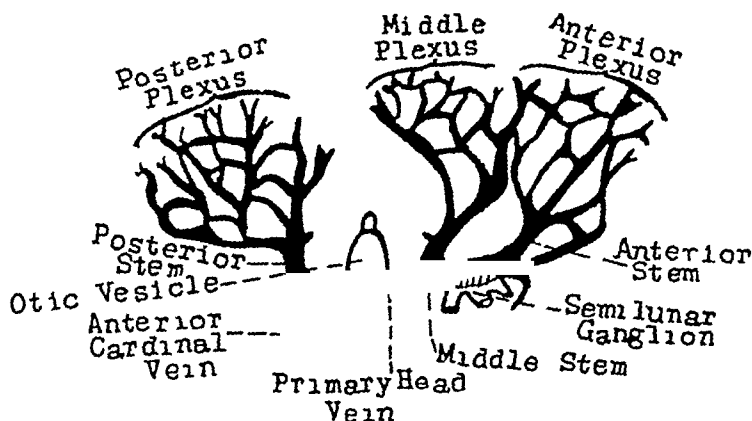


Fig 4—Diagram of primary head vein and tributaries (after Streeter)

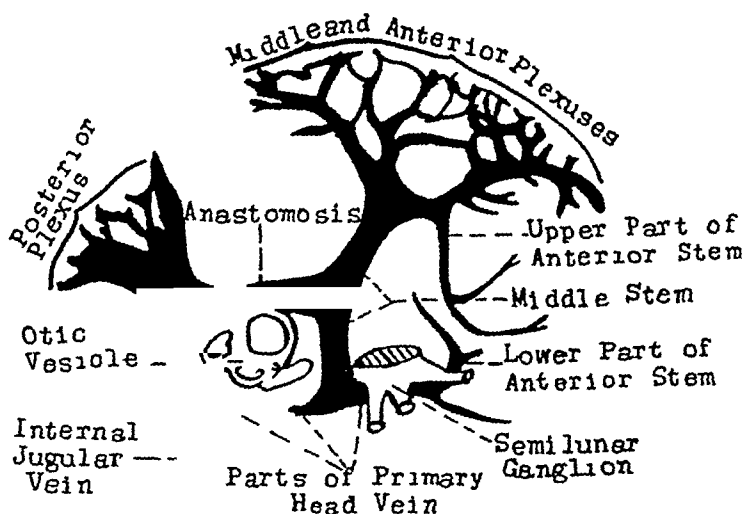


Fig 5—Diagram of head veins of an embryo of 21 mm (after Streeter)

inferior sagittal sinuses and the straight sinus. By further growth of the hemispheres, the upper part of the tributary of the middle stem on each side is forced backward and then downward until it becomes the horizontal part of the transverse sinus, the anastomosis above the otic region and the tributary of the posterior stem is converted into the sigmoid portion of the transverse sinus.

Of interest also in this connection is the mode of formation of the external jugular vein. In embryos of guinea-pigs this vein is formed

by the union of a branch which has connected the ophthalmic and the anterior facial veins with a vein extending down from the region of the ear. The external jugular unites somewhat later with the sinus transversus by an anastomosis through the foramen jugulare spurium. Hochstetter⁶ stated

This anastomosis becomes more and more prominent and brings more and more blood from the sinus transversus to the external jugular, with the result that the internal jugular always becomes narrower and finally entirely disappears. Thus the vena jugulare externa becomes the chief channel for the venous blood of the head, in this and apparently all other mammals possessing a foramen jugulare spurium.

Keeping in mind the outline of the venous development inside the skull, one sees that this circulation is by no means constant for all

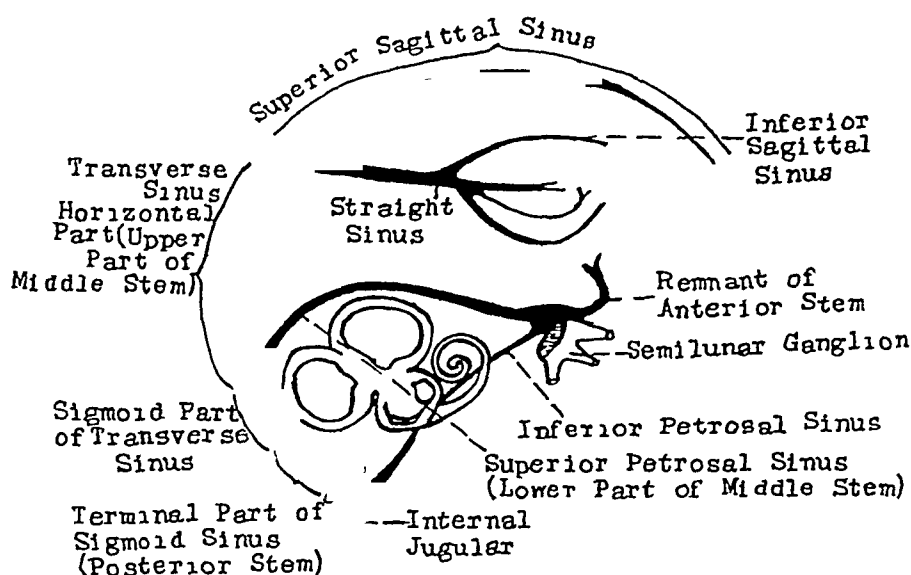


Fig 6—Diagram of the venous sinuses (only one transverse sinus shown) After Cunningham Anatomy, ed 5, New York, William Wood & Company

mammals. It is interesting to note also that in certain animals, such as the guinea-pig and dog the internal jugular vein as such does not exist, its function being carried on by the external jugular vein, that is, the latter "becomes the chief channel for the venous blood of the head."

COMMENT

Returning now to the specimens and in the light of what has preceded I shall venture certain opinions. Looking again at the sketch picturing the sinus petrosquamosus (fig 3), one recognizes it now as the remains of that primitive blood channel in the embryo which lay lateral to the otic vesicle. In speaking of the condition existing in an embryo of 20 mm, Streeter stated

Tracing the cavernous sinus backward, it can be seen that the interruption between it and the internal jugular vein is complete, though there is still a remnant of that connection, which extends as a blind channel a short way along the facial nerve. It is interesting to note that we occasionally find in the adult skull a persistent foramen, the "foramen jugulare spurium of Luschka," which corresponds to the exit of the decadent channel. The vein itself, however, has never been described as persisting, although it exists normally in lower forms as a drainage for the anterior part of the brain, passing through this extracranial course to empty into the internal jugular vein.

The anomaly referred to, therefore, may be looked on as the remains of that venous channel which normally exists for a time in the human embryo and persists in some mammals during postfetal life.

A summary of the developmental factors involved will be of assistance in an explanation of the absence of the sigmoid sinus in the first specimen. Here it was shown that the right sigmoid sinus was entirely absent, its function in part being taken up by a large mastoid emissary draining into the external jugular system. The internal jugular vein was a small channel and served only to receive the blood from the inferior petrosal sinus.

By comparing figure 6 with figures 1 and 3, one notes that that portion of the transverse sinus lacking in my specimen is that represented by the tributary of the posterior stem. That part of the transverse sinus (horizontal part) originating from the upper portion of the tributary of the middle stem is present and drains into the enlarged mastoid emissarium. However, the derivative of the lower part of the middle stem, the superior petrosal sinus, is also lacking. Thus it is seen that the representatives of those elements which enter into the formation of the anastomosing channel (the posterior stem tributary plus the lower part of the middle stem tributary) are the ones absent in my specimen. It may be reasonable, therefore, to conclude that, owing perhaps to some disturbance in the mechanical factors involved in normal development, this anastomosis probably never did take place.

Without such anastomosis the venous drainage had to undergo certain modifications. Thus, a large mastoid emissarium developed to enable it to carry the blood from the horizontal portion of the transverse sinus to the external jugular system, while the internal jugular vein, receiving only the blood from the inferior petrosal sinus, remained correspondingly undeveloped and lacking in a bulb.

OCCURRENCE OF EOSINOPHILS IN THE MUCOUS MEMBRANE OF THE MAXILLARY SINUS IN ASTHMATIC PATIENTS

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AND
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Clinical experience has firmly established the relationship of rhinologic disturbances to asthma. The generally prevailing view is that certain types of asthma are affected by disease of the upper respiratory system, and it is that which is predominately concerned. That other regions are concerned is often manifested either through toxic conditions, allergic phenomena or through reflex actions. Since we are concerned only with that form of asthma which is caused by or associated with a rhinologic disturbance, we shall therefore omit all other causes.

The importance of a nasal factor in asthma can be gaged from several considerations. We have observed that asthma is often associated with vasomotor rhinitis, recurrent rhinitis, hay-fever, nasal polypi and similar conditions. In analyzing a group of cases, we have found that in about 75 per cent nasal polypi were secondary to a pathologic process in the maxillary sinus, and a fair percentage of these culminated in asthma. Our attention was therefore drawn to the pathologic change in the maxillary sinuses and its relationship to asthma. The pathologic consideration cannot be too much emphasized. In the microscopic study of the mucous membrane of maxillary sinus tissues, we found that there are certain characteristic cellular elements that are constantly present in the tissues. Among these are the polymorphonuclears, lymphocytes and the eosinophils. These are found in the tunica propria. The eosinophil is a factor in all inflammations irritative rather than infective in character. It is a constant component factor when the tissues are edematous, as in hay-fever and vasomotor rhinitis (as pointed out by the late Harry P. Finck¹).

The lymphocyte is present where chronicity ensues, while the polymorphonuclear leukocyte appears during suppuration and replaces the other cellular elements. In a group of asthmatic cases associated with suppuration of the maxillary sinus, the eosinophil was an element that

* Submitted for publication, Aug. 30, 1929.

1 Finck, Harry P. Tissue Changes in the Nasal Mucosa, *Tr. Am. Laryng., Rhin. & Otol. Soc.* **33** 63, 1927.

was constantly present in such a profound proportion that we felt that this characteristic should be regarded as a distinct entity, and we are therefore presenting this subject for consideration.

The hypothesis is this. It is true that eosinophils are found in the blood, and it is also an established fact that eosinophilia is found in the various subacute and chronic diseases, among which are the various rheumatoid conditions, diseases caused by intestinal parasites, chorea, asthma and other conditions. In view of the fact that the eosinophil is the cellular element present in the blood in these chronic conditions, the following questions arise. First, is it a result of a protein disturbance or a phenomenon present in allergy, or is it simply a reaction to stimuli of a specific or nonspecific character? The question in our minds has always been. Is the mucous membrane itself the harboring factor in the causation of asthma? Often one is led to believe that such may be the case because of the great proportion of eosinophils that we have observed in some of these tissues. Second, is the eosinophil the result of some form of protein split-up liberating certain substances that produce a form of allergy and secondarily causing asthma, or is it not? Third, can we ascribe it to lessened ciliary motility or ciliary changes which obviously cause impediment to the removal of the secretions with a certain amount of secretory stagnation, or is it a consequential protein split-up with a production of various enzymes that probably cause asthma? Fourth, in several specimens, we found lymphocytes, polymorphonuclear leukocytes and a great number of eosinophils. At the time of operation, free pus was found. Would this observation point toward bacterial infection as a causative factor in the production of asthma, or is the infection incidental rather than actual? Fifth, is asthma a mechanical disturbance resulting from the edematous tissue throughout the nasal and maxillary sinus mucous membrane, or is it a combination of the edema plus the secondary infection?

Various sensitization tests were made on these patients. Some were sensitive to pollens and others to various foods, while the reactions in some were negative. The outstanding features of some of the allergic cases in which the patients were tested were the abnormal dermal reactions. Those patients who had positive reactions were desensitized, but few responded to the treatment. In another group, both vaccines and protein extracts were administered, but the conditions were not amenable to this form of treatment, some patients even becoming worse. This observation leads one to suspect that when a great number of eosinophils are present, protein inoculations, whether they are vaccines or substances to which the patient showed a reaction, may be a detriment rather than an aid. This may be explained by the fact that we already have a protein cellular imbalance, and therefore the protein

inoculated may aggravate rather than improve the condition. Fink observed that when infection takes place, the eosinophil disappears and the other cellular elements, such as the polymorphonuclear leukocytes, make their appearance. This may be a point in favor of large doses of vaccine which produce reactions with possible cellular changes from the eosinophil to the polymorphonuclear leukocyte or to the lymphocyte.

Clinical observation seems, therefore, to suggest the eradication of local infective conditions, and also favors the idea that the local pathologic process is a factor in the causation of asthma.

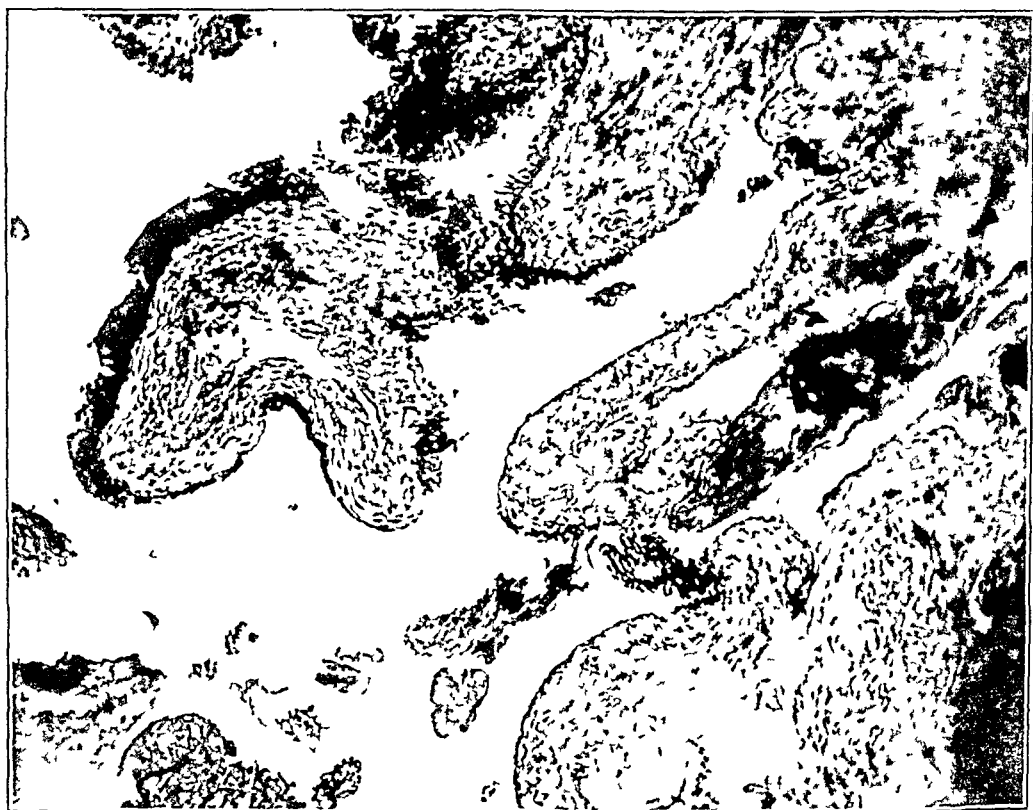


Fig 1—Section of mucous membrane from a healthy antrum of Highmore (objective $\frac{2}{3}$, eye piece no 2). This section shows fragments of normal mucosa and submucosa.

The results that were obtained from the patients on whom radical operations on the maxillary sinus were performed may be divided into those that were "cured," "benefited," "greatly relieved" and "not worse." It would be interesting to know whether the eosinophils recur after radical operations on the maxillary sinuses are performed and how soon after operation they appear, which would be ascertained only by secondary operation.

The pathologic process found in the study of fifty cases of chronic maxillary sinusitis in which the patients were operated on radically consisted of hypertrophic or atrophic mucous membrane, polyps or a

combination of both hypertrophic and atrophic tissues. The cellular elements in the tissues were round cell infiltration, lymphocytes, polymorphonuclear leukocytes and occasional eosinophils in the non-asthmatic group. The asthmatic membrane presented a predominance of eosinophils with some polymorphonuclear leukocytes and lymphocytes. In brief, the pathologic histology obtained from the mucous membrane from the antrums of asthmatic patients was as follows: Columnar epithelial cells cover the surface of the tissue. The cell lining



Fig 2—Section of mucosa of an infected antrum of Highmore showing hypertrophic changes of fibromyxoma (polyp) (objective $\frac{2}{3}$, eye piece no 2). The columnar epithelium of the mucosa shows marked catarrhal changes along with myxomatous degeneration of the submucosa with lymphocytic infiltration due to chronic infection.

often dips down deeply into the connective tissue and forms small crevices which in some cases branch. In a number of instances, the epithelial cells were hydropic and overlaid with a thick amount of mucus. Occasionally we found several layers of cells. Directly beneath the basement membrane there is an acellular hyaline zone. Beyond this there are areas of edematous connective tissue which contain many cells

The eosinophilic leukocytes predominate. The remaining cells consist of polymorphonuclear leukocytes and lymphocytes.

In the accompanying illustrations the histopathology of the maxillary tissues is seen. From these one is able to visualize the contrast between the normal and the various types of the nonmalignant pathologic tissues encountered in various chronic maxillary diseases.

Figure 6 illustrates the typical type of tissue found in asthmatic patients showing the epithelium, the tunica propria and the predominance of the eosinophil, the occasional lymphocytes and the polymorphonuclear cells.



Fig 3—Section of mucosa of an infected antrum of Highmore showing hypertrophic changes of cystic fibromyoma (objective $\frac{2}{3}$, eye piece no 2). The columnar epithelium of the mucosa shows some catarrhal changes along with cystic distention of glands in the submucosa, myomatous degeneration and small round cell infiltration.

The following case is typical of those in the asthmatic group.

REPORT OF CASE

History—M. P., a woman, aged 60, gave a history of stuffiness of the nose, profuse rhinorrhea and recurrent attacks of asthma and dyspnea for nearly three years. Several nasal operations had been performed on the patient, namely, submucous resection, removal of polyps, enteration of the nasal maxillary sinus on

the left side and partial exenteration of the ethmoids. The general symptoms were asthma, dyspnea and severe cough.

Examination—There was a vasomotor appearance of the mucous membrane of the nose. It was difficult to contract with shrinking solutions. Small polyps were seen on the right side around the middle meatus. The nasopharyngoscope showed the presence of polyps. On transillumination both maxillary sinuses were cloudy. On puncture, pus was found on the right side consistently and occasionally on the left side. Roentgen examination revealed cloudy maxillary sinuses.

No improvement in symptoms followed repeated irrigations. Iodized poppy seed oil 40 per cent was instilled in the antrums, and an x-ray picture showed little displacement.

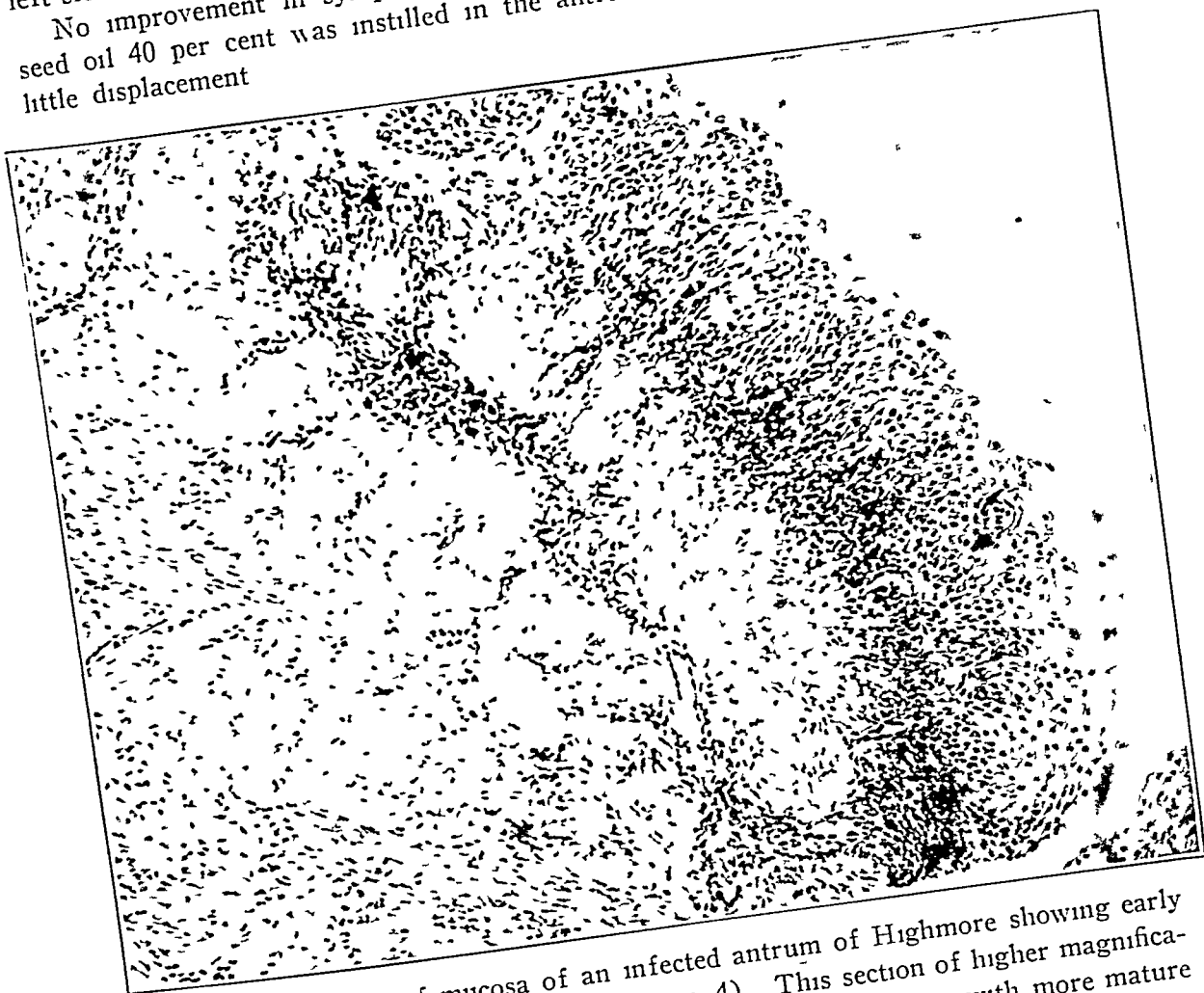


Fig 4—Section of mucosa of an infected antrum of Highmore showing early atrophic changes (objective $\frac{1}{6}$, eye piece no 4). This section of higher magnification shows desquamation of the epithelium of the mucosa along with more mature fibrous tissues in the submucosa with beginning contraction.

Operation and Course—Polyps and pus were removed, and a bilateral Caldwell-Luc operation was performed.

Bacteriologic study revealed the presence of *Streptococcus hemolyticus*. Microscopically, fibromyxoma with chronic inflammatory tissue was seen.

The patient had no abatement of symptoms after submucous resection, removal of polyps and intranasal maxillary operation. After a bilateral Caldwell-Luc operation was performed, all asthmatic symptoms disappeared, and up to the time this article was written (two years later) symptoms have not recurred.

To make a brief summary of the subject, we advance the following conclusions

1 The asthmatic patients on whom Caldwell-Luc operations were performed represented three types (a) the hydropic or vasomotor type, (b) the suppurative type and (c) the nonsuppurative type. These, from a rhinologic standpoint, presented different symptoms, but in our histopathologic study we found that the eosinophil was the predominant cell



Fig 5—Section of mucosa of an infected antrum of Highmore showing hypertrophic and atrophic changes (objective $\frac{2}{3}$, eye piece no 4) Section of the tissue from Mrs B showing chronic fibrous and atrophic changes in the mucosa and submucosa of the tissue from the maxillary sinus

2 The cellular elements present were polymorphonuclear leukocytes, lymphocytes and eosinophils. The polymorphonuclear leukocytes and the lymphocyte cells were found in great proportion in the non-asthmatic patients, but the eosinophil was found in abundance in the pathologic tissues of the asthmatic patients

3 *Streptococcus hemolyticus* was the organism isolated in the study of the asthmatic cases

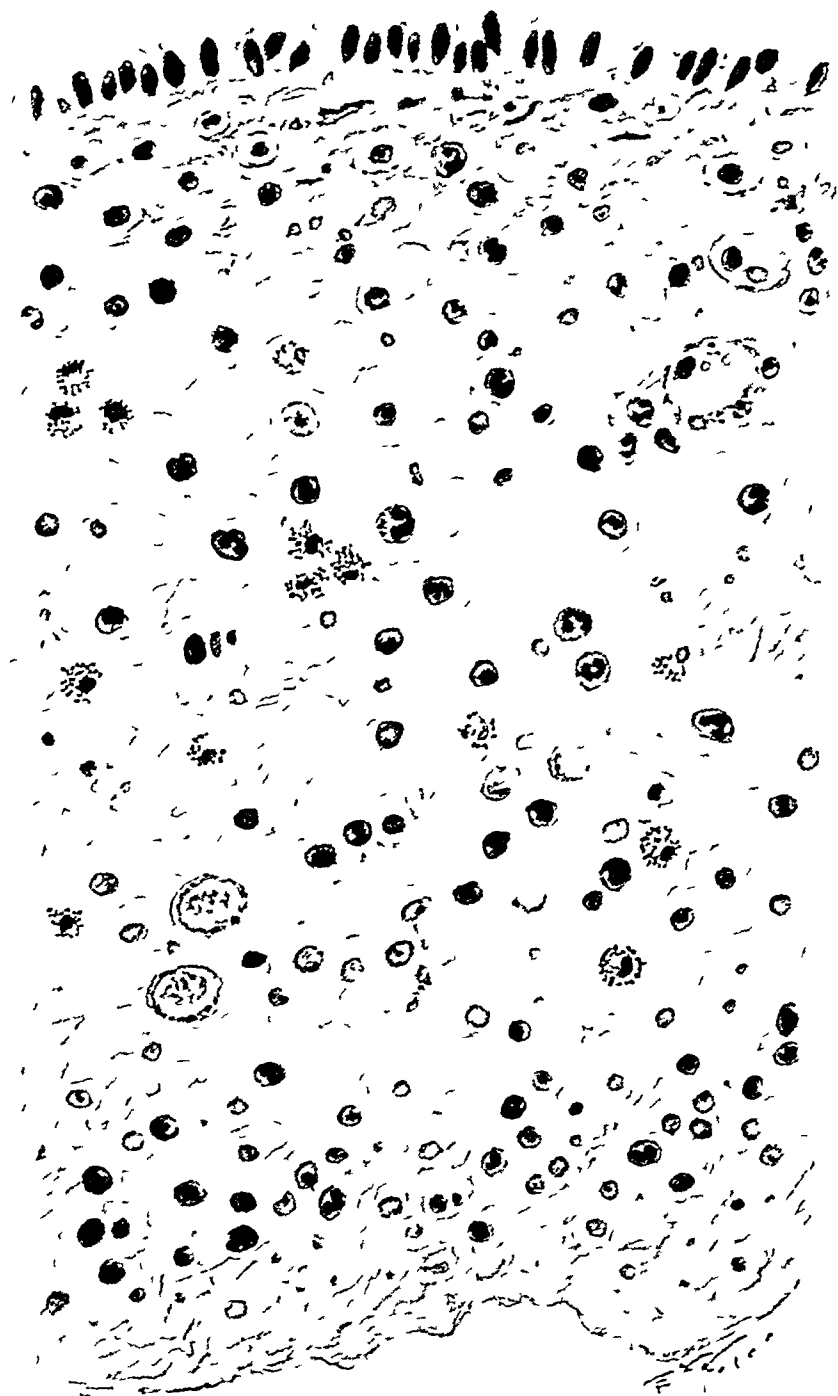


Fig 6—Mucous membrane of antrum of asthmatic patient This figure shows columnar epithelium and hydropic areas, and beneath the basement membrane we find the eosinophils predominating The cells are polymorphonuclear leukocytes and lymphocytes with a higher power, the eosinophils may be seen within the blood vessels

4 The question of tissue regeneration and cellular element recurrence is of great interest. A patient comes to mind whose symptoms reappeared three years after operation. Why? According to Knowlton,² there is a regeneration of nasal mucous membrane following radical operation on the maxillary sinus. We have not had the privilege of reoperating on our own patients so as to determine the pathologic process and cytology present, but it is possible that after a three years' quiescence, there may follow a recurrence of symptoms, and the new tissue formed can be reinfected. This would be a point in favor of the theory that a local pathologic process is a factor in the causation of asthma.

Schilling and Gradwohl³ promulgated the idea that the eosinophil is a cell that is present in the blood normally. They further stated that during acute infection there is a disappearance of the eosinophil, it being replaced by the polymorphonuclear leukocyte or the lymphocyte. This observation does not coincide entirely with our results. There are several explanations for this. Among them is the ratio and its relationship to the other cellular elements. Normally, in an ordinary blood count one finds one eosinophil to the average count. In acute infection, there is a disproportionate increase in the polymorphonuclear leukocytes, and when there is a tendency to chronicity—there is an increase in the lymphocytes. Using the eosinophil as 1 in the ratio, it is natural to expect that when there is an actual increase in the other cellular elements, the eosinophil naturally remains nil.

We found, on the other hand, that the eosinophil is present in the mucous membrane of an asthmatic patient in conjunction with purulent conditions in the same membrane. Therefore, it seems logical to assume that the asthma and the presence of the eosinophil in the mucous membrane must be closely associated.

ABSTRACT OF DISCUSSION

DR HARRY D. EARL, San Pedro, Calif. I wonder if any one knows what is the function of the eosinophil? If its function were known, the problem that Dr. Coates has attacked would be more easily solved. Now that Dr. Coates has found it in large numbers in the mucosa of asthmatic patients with chronic disease of the antrum, at once the question arises, what of the other sinuses in these cases? Is there an increase of eosinophils in the mucosa of the frontal, the ethmoid and the sphenoid of these patients, or is the increase confined to the antrum? The fact that so many of the patients in Dr. Coates' cases were cured by radical operations on the antrum, not only of the condition of the antrum but of the asthma as well, indicates that the antrum plays a more important and far-reaching role in diseases of the respiratory tract than we have attributed to it.

² Knowlton, Charles D. How and When the Mucous Membrane of the Maxillary Sinus Regenerates. An Experimental Study in the Dog, *Arch Otolaryng* 8 647 (Dec.) 1928.

³ Schilling and Gradwohl. *The Blood Picture*, ed. 7 and 8.

We have seen cases of acute pansinusitis and bronchitis in which the patients were relieved promptly and then cured simply by repeated puncture and lavage of the antrums. This being a fact, does it not tend to substantiate in part Dr Coates' observations, namely, the cure of asthma by curing the antrums in patients with pathologic changes in the sinus?

DR HARRY L. BAUM, Denver. The authors have not answered any of the questions they have raised. I presume they did not intend to answer these questions, but to bring them before us for our consideration and for our answer if we have one. I, too, have considered them with deep interest for a considerable length of time, but so far I have been unable to prove any of the conclusions I have drawn. I have some theories, in some of which I believe rather firmly, but I have no proof. The question of the association of asthma with certain conditions in the nose is, of course, firmly established. First, with many known allergic conditions such as hay-fever and vasomotor rhinitis, and second, with conditions that are not known certainly to be allergic but which are now more or less accepted as being so, such as the edematous states of the nasal and sinus membranes. The most common, of course, is the nasal polyp. Those who have made a study of the histology of these conditions have recognized the frequent presence of eosinophils in the membranes. The question the essayists ask is briefly this: Is the presence of eosinophils a specific or a nonspecific reaction? I believe it is a nonspecific reaction, because we find eosinophils in the blood and also in other tissues in diseases which have no relation to asthma. I would therefore conclude that it is a reaction to some general underlying condition that we have as yet been unable to explain. Eosinophils are present in the blood and bronchial mucosa as well as in the nasal and sinus membranes in asthmatic patients, so I cannot help but conclude that they are evidence of a reaction to some unknown stimulus and not in any way the cause of the asthma.

The writers of the paper ask five other questions which are all pertinent and interesting. First, is the nasal mucosa a harboring factor in asthma? It is possible, but I do not believe that the changes seen in the nose and sinuses are more than concomitant, simply nasal manifestations of the same state just as the asthmatic attack is a bronchial manifestation of that state. Both are associated conditions, one is not a cause of the other. Second, is the eosinophil the result of protein split-up? That question I shall leave to Dr George Piness. He knows much more about proteins than I do. Third, what has lessened ciliary activity or stagnation to do with the development of asthma in this type of case? We well know that we frequently find stagnation in these cases as evidenced by pus in the sinuses. What has that to do with the causation of asthma? I would say that it plays a secondary role, since there are cases of asthma in which there is no apparent interference with ciliary activity and in which there is no stagnation. Fourth, is the presence of pus in the antrum an indication of the bacterial origin of asthma? The only evidence to bear out this conclusion is the improvement noted as a result of antral drainage in some cases of asthma in which pus is present. Sensitization to bacterial proteins has not been demonstrated, so this hypothesis is difficult to maintain, even in the light of unquestioned therapeutic effect in certain clinical cases. On the other hand, the frequent failure of surgical eradication of suppuration and the failure of treatment by means of desensitization with bacterial proteins lead me to the conclusion that pus is not the active etiologic factor in asthmatic cases with antral suppuration. Fifth, is asthma a mechanical disturbance resulting from the presence of edematous tissue in the sinuses? To this question I would unhesitatingly reply that it is not. Edema is a characteristic and not a cause of all allergic states. We should not confuse cause and effect.

in our consideration of allergic states. In conclusion I would emphasize that eosinophilia and edema are the accompaniment of allergic states as manifested in the respiratory mucous membranes, both upper and lower, and do not tell the real story of the underlying cause of asthma. I cannot escape the conviction that they are only symptoms and never causes.

DR HARRIS P MOSHER, Boston. It is held now that the eosinophil is found associated with asthma. About a year ago, having established a laboratory for the study of the mucous membranes, we attacked this problem, but frankly, we have not gotten far. The first case was one of asthma with eosinophilic pus in the nose, the antrum was full of eosinophilic pus, and the membrane removed from the antrum was full of eosinophilic pus. That excited us, but we have not been able to repeat that observation. We do not feel that eosinophils are constant in cases of asthma. They are common, but they are not constant. The odd idea has originated in Boston that asthma is not caused by the sensory centers, but is a secondary effect of a constitutional upset, whatever that constitutional upset may be. Dr Casner has done some splendid work along the line of the histopathology of the mucous membranes of the nose and especially of the antrum. Our observations have been practically his with one exception. In other words, we have not found polymorphonuclear leukocytes in the mucous membrane in great numbers. Why they are not there we cannot make out. I have a suspicion that pus may be an innocent factor—that it is Nature's expression of being able to combat the infection. We found lymphocytes, even in the acute cases, to predominate. I should like to add one thing to what Dr Coates brought out about the eosinophil. It will disappear promptly after treatment in most cases, either with or without operation, and stay away for five days and then come back—and so does the asthma.

DR GEORGE PINESS, Los Angeles. The cases studied by Dr Coates and his workers may be divided into two groups, allergic and nonallergic asthma, the latter because no reactions were obtained by skin testing as well as no etiology determined by means other than the presence of pus in the nasal sinuses. It is, therefore, called bacterial asthma or asthmatic bronchitis. Much work has been done with the latter group in attempting to determine whether or not the subject is bacteria sensitive, but no evidence of specific sensitivity due to bacteria found in the various sinuses and cells of the nose has been offered that is conclusive that they produce bronchial asthma. Our own observations in cases of so-called bacterial asthma are that when pus is present it is usually the result of obstruction of drainage caused by the edema described by Dr Coates, and despite the free drainage and removal of the focus of infection by surgical measures, little if any success is attained in relieving the patient from his asthma. The presence of eosinophils in bronchial asthma is not constant, as characterized by the case reported by Dr Mosher. Eosinophils may or may not be present in excess of the normal proportion to other leukocytes. I do not believe that their presence is pathognomonic of allergic disease, as many times they are found in excess in other conditions. The asthmatic patient who presents a picture of round cell infiltration with connective tissue formation has, without a doubt, a bacterial infection, and this is commonly seen in the bacterial type of asthma, but the picture of edema of the mucous membrane throughout the entire respiratory tract with infiltration of leukocytes, eosinophils, etc., is truly allergic. Dr Coates' observation that patients sensitive to specific proteins who have unusually large numbers of eosinophils present do not respond to specific treatment, does not bear out our own observations. We have noted that equally good results are obtained in those that have unusually large or normal amounts of eosinophils present. It is my belief

that most poor results that occur in sensitive persons are usually due to a failure on the part of the clinician to correlate properly the history of the patient and the results of his laboratory and protein studies. It is believed by most workers that proteins that are split by chemical or physical means or that are denatured lose their ability to produce allergic reactions.

DR JOSEPH C. BECK, Chicago. After a discussion like this there is not much more to be said, but two facts may have been left out in regard to asthma. One is the work of Sturm Von Leeoven which some in this country discredit, but in Europe we hear so much about his views concerning the specificity of *Aspergillus fumigatus* in asthma, also patients breathing in cabinets or small rooms, that air that has been frozen to a low degree and rewarmed are thus desensitized against *Aspergillus fumigatus*. Dr Meyers of South Bend, Ind., made a special trip to see this work in Leiden, Holland. He has recently returned, and I am authorized to make the statement that all the facts set forth by Sturm Von Leeoven are not borne out in the cases he has observed, but that the treatment has had a beneficial effect on the patients subjected to it. The work presented by Dr Coates was interesting to me because I have been studying the mucous membranes of the sinuses in patients with asthma for a long time. I have four photographs in which this fact of eosinophilia in the tissues is not substantiated. In the majority of cases the mucous membrane lining not only of the antrum but of the other sinuses is not found as set forth, it is mostly chronically inflamed, and evidences of chronic edema are present. With reference to the case reported in which there was two years' relief from asthma following operation on the antrum, I want to congratulate Dr Coates. No other sinus was operated on and therefore two years should be long enough to say that the patient is cured. I am certain that I have never had a patient cured by an operation on the nose alone—cured so that the asthma did not return.

DR GEORGE M. COATES. This is just an attempt to bring the subject forward. We are all familiar with the work of Finck on the mucous membranes of the nose, and in conversation with Emerson and Tobey they said their observations had been the same as ours, but we were unable to find published reports on this subject. Dr Beck says he does not find the eosinophils in the proportion we have found them. Of course, our series is small, it is a study of fifty consecutive cases, in which we included nine asthmatic patients, and we were struck by the fact that in the nine patients with asthma we found a preponderance of eosinophils, while in the nonasthmatic subjects we did not find them. I do not know that we cure the asthma any more than we cure cancer or tuberculosis. We cannot call it cured in two years, although we have accomplished something. The patients in these nine cases were relieved for a period—three years is the longest, and in one case there was a recurrence.

THE FREQUENCY OF MASTOIDITIS IN INFANTS³

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AND

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Much controversy has arisen regarding the relationship between mastoiditis and acute nutritional disturbances in infants. Since the publications of Marriott, Alden, Floyd, Lyman and many others,¹ a great deal of attention has been given to infections of the middle ear and the mastoid. The work of these men has been so startling that a great number of pediatricians and otologists have, we believe, without careful investigation, more or less blindly followed their teachings.

The contention of most investigators has been that the ear infection acted as the primary focus, and that the enteric disturbance was secondary. The result has been a marked increase in the number of ear drums lanced and mastoids operated on.

Our contribution to this subject is an effort to determine, by careful examination of the end-results, i. e., by necropsy and histologic studies, the correct relationship between enteritis and ear infection.

About a year ago, one of us (O. J. D.) published the results of a survey in cases of mastoidectomies which he had gathered from the private and charity hospitals of Kansas City, with this conclusion: "The mortality rate in infants with enteritis, who had mastoidectomies was out of all proportion to the usual mortality rate, that is, six and four-tenths as against two and four-tenths normally."

There have been two outstanding contributions to this subject from the standpoint of postmortem and histologic study. The first was by McMahon,² who made a careful analysis of the histologic changes in a series of cases in which operation was done. In his first table he cited eight cases, in six of which the patients died following operation. On analyzing the microscopic observations in the bone from this series he found that the predominating features were edema, many

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1 Marriott. Observations Concerning the Nature of Nutritional Disturbances, Read before the American Pediatric Society, Washington, D. C., May 5, 1925, quoted by McMahon (footnote 2). Alden, A. M. Mastoid Infections in Infants, *Arch. Otolaryng.* **5**: 39 (Jan.) 1927. Floyd, M. L. Masked Mastoiditis Simulating "Alimentary Intoxication" (Anhydremia), *Arch. Otolaryng.* **1**: 411 (April) 1925. Lyman, H. W. Mastoiditis a Cause of Gastro-Intestinal Disturbances in Infants, *J. Missouri M. A.* **22**: 293 (Aug.) 1925. Dixon, O. J. The Causes of Death in Mastoiditis, *J. A. M. A.* **91**: 1280 (Oct. 27) 1928.

2 McMahon, B. J. The Pathology of Mastoiditis in Infants, *Arch. Otolaryng.* **7**: 13 (Jan.) 1928.

red cells and pus cells. McMahon stressed the presence of edema. Bony necrosis, he stated, was either slight or not present. All these observations show the reaction to be obviously early and acute. In a personal communication to the authors, he stated that the diarrhea-vomiting complex was of much longer duration, clinically, than the ear symptoms, when the latter were present. This, we think, and will try to show later, is in accord with the microscopic observations, and corresponds well with the observations in our cases.

The second noteworthy contribution, and of a somewhat different nature, was that of Richards³ of Boston, who reviewed the records of postmortem examinations of 120 infants with particular attention to the observations in the ears and mastoids. His figures showed little difference as regards changes in the ears between infants dying from nonnutritional and those dying from nutritional disturbances and he concluded that "the infection of the middle ear with or without mastoiditis, is in infants at least a prevalent complication of a large number of fatal illnesses and that the opinion that this local aural infection is a factor of peculiar etiologic significance in acute nutritional diseases is not borne out by these authentic figures" (i. e., postmortem observations).

In 1926 when the publications regarding middle ear and mastoid infections as the primary foci came to our attention we were obtaining a high percentage of postmortem examinations on infants dying at Children's Mercy Hospital and were struck by the fact that we found pus in the middle ears and mastoid antriums in a large number of infants dying from all types of diseases. Therefore we began making careful postmortem studies of all cases in which mastoiditis was encountered. This investigation comprises a series of 173 postmortem examinations taken in sequence from January 1927 to June 1, 1929. The patients came from the entire pediatric and otologic services of the Children's Mercy Hospital. The most interesting and instructive part of the study is, perhaps, the fact that the opinion of the attending staff regarding the etiologic significance of ear infection in enteritis was about equally divided.

In this series of 173 necropsies we encountered fifty-seven cases in which changes were present either in the middle ear or in the mastoid or in both (32.8 per cent). This demonstrates the striking frequency of this complication. We have therefore tried to make a careful analysis of these fifty-seven cases in an effort to determine the relationship of mastoiditis to enteritis.

A review of the accompanying table reveals the following facts. In only seventeen of these fifty-seven cases was there evidence of

3 Richards, Lyman. Mastoiditis in Acute Nutritional Disturbance, *Arch Surg* 18:1774 (April) 1929.

TABLE 1—*Observations in Cases Showing Ear Involvement*

Necropsy Number	Age of Child	Sex	Primary Disease	Duration	Mastoidectomy	Postmortem Observations		
						Mastoid	Bone Changes	Complications
27-2	19 months	F	Tuberculosis, cervical cellulitis	14 days	None	Bilateral purulent mastoiditis	Slight	Cellulitis of neck
27-4	3 months	F	Cellulitis of scalp	3 days	Bilateral paracentesis no mastoidectomy	Only mucus in mastoid	None	Pneumonia
27-10	8 years	M	Peritonitis, abscess	21 days	None	Mucus in mastoid, with streptococcus	None	Measles, myocarditis
27-11	24 months	M	Measles, streptococcal pharyngitis, bronchitis	90 days	None	Mucus in mastoid	None	Cellulitis of neck, gonorrheal urethritis
27-16	1 month	M	Feeding case	Since birth	None	Thick yellow-green pus	Some	Septicemia, acute pancreatitis, myocarditis
27-20	7 months	M	Malnutrition, rickets, never developed	Since 4 weeks of age	None	Mucus in left mastoid, pus in right mastoid	None	Broncho pneumonia
27-22	Unknown, under 1 year	M	Extreme emaciation, dehydration	21 days	None	Mucus in mastoid	None	None
27-24	Unknown	F	Pneumonia	Unknown	None	Pus	Necrosis	Abscess of lung, meningitis
27-25	6 months	F	Acute diarrhea	7 days	Bilateral paracentesis, no mastoidectomy	None	None	Bled to death from drum incision
27-26	4 months	F	Cellulitis of scalp, with abscess	10 days	None	Pus, bilateral, streptococcus	None	Terminal mastoiditis, septicemia
27-28	5 months	M	Primary mastoiditis	14 days	Right side mastoidectomy	Broken down	Present	Meningitis
27-31	7 months	F	Von Jaeksch anemia	14 days	None	Otitis mastoiditis	Present	Measles
27-32	11 months	M	Feeding case	30 days	None	Bilateral otitis and mastoiditis	None	Pneumonia, multiple abscesses
27-33	1 month	M	Pemphigus infection of kidney	22 days	None	Pus in left mastoid, suppurative streptococcal otitis in right ear	None	Jaundiced, dehydrated, broncho pneumonia, pyelonephritis
27-36	1 month	M	Mastoiditis	3 days	None	Thick green pus in right mastoid, left clean	None	Massive hemorrhage of the brain
27-40	12 months	F	Pneumonia	7 days	None	Right side mastoiditis, otitis	Slight	Toxic myocarditis
27-62	8 months	F	General miliary tuberculosis	30 days	Bilateral	None	Slight	None
28-2	22 months	M	Broncho pneumonia	6 days	None	Foul, thick pus	Slight	Nephritis
28-6	5 months	M	Mumps	60 days	Paracentesis, mastoidectomy	Bilateral purulent otitis	None	None
28-12	24 months	M	Diarrhea	14 days	Bilateral mastoidectomy, earlier paracentesis	None	Necrosis	Pachymeningitis

TABLE 1—Observations in Cases Showing Late Involvement—Continued

Necropsy Number	Age of Child	Sex	Primary Disease	Duration	Mastoidectomy	Postmortem Observations		
						Mastoid	Bone Changes	Complications
28 13	11 months	M	Rickets	30 days	Bilateral mastoidectomy	Slight changes pus	None	Broncho pneumonia
28 23	months	M	Pneumonia	10 days	Bilateral mastoidectomy paracentesis	Left side mastoid and antrum infected	None	None
28 27	3 years	M	Pneumonia	120 days	Bilateral mastoidectomy paracentesis	Broken down	Present	Empyema pneumonia
28 28	9 years	F	Pharyngeal abscess	5 days	Bilateral mastoidectomy paracentesis	Seropurulent	None	Impetigo malnutrition terminal broncho pneumonia
28 29	18 months	M	Diarrhea	21 days	None	Pus	Slight	Broncho pneumonia
28 30	10 months	F	Diarrhea intestinal upset	42 days	None	Ruptured drum fairly dry ear	None	None
28 34	8 months	F	Pyelonephrosi suppurative nephritis	12 days	No mastoidectomy paracentesis	Bilateral otitis	None	None
28 36	3 months	M	Enteritis	10 days	No mastoidectomy paracentesis	Poly morphonuclear infiltration	No caries	None
28 43	months	M	Tuberculosis septicaemia	Unknown	Bilateral	Pus	None	Multiple abscesses of lung
28 44	3 months	M	Diarrhea	7 days	No mastoidectomy, paracentesis	Small amount mucus	None	None
28 45	2 years	M	Chronic ulcerative ileocolitis	25 days	Bilateral	Pus	None	None
28 47	3 months	M	Enteritis	21 days	Bilateral	Bilateral mastoiditis with pus	No caries	Furunculosis bilateral confluent bronchopneumonia
28 49	5 weeks	M	Feeding case	14 days	Paracentesis no mastoidectomy	Thin mucus	None	Pneumonia
28 52	2 months	M	Diarrhea acute and chronic ileocolitis marked in testinal change	10 days	Bilateral mastoidectomy paracentesis	Both middle ears have slight purulent involvement	None	None
28 54	4 months	F	Diarrhea	14 days	None	Filled with thick green pus	None	Terminal ear complication
28 56	12 months	M	Acute ulcerative membranous enteritis	6 days	Bilateral	Purulent otitis mastoiditis	None	None
28 57	7 months	M	Enteritis vomiting general miliary tuberculosis	30 days	Bilateral mastoidectomy	None	None	Tuberculous enteritis
28 58	2 months	M	Congenital syphilis, feeding case	30 days	Bilateral mastoidectomy	Pus in mastoid	Slight	Pneumonia

TABLE 1—*Observations in Cases Showing Ear Involvement—Continued*

Necropsy Number	Age of Child	Sex	Primary Disease	Duration	Mastoidectomy	Postmortem Observations		
						Mastoid Granulations	Bone Changes	Complications
28 63	2 months		Sepsis malnutrition	23 days	Bilateral mastoidectomy, paracentesis		Bone lost	Abscesses of lung
28 66	5 months	F	Enteritis	90 days	Bilateral mastoidectomy, paracentesis	Pus, granulations	None	Erysipelas
28 67	4 months	M	Severe malnutrition, diarrhea	Unknown	None	Bilateral purulent mastoiditis	None	None
28 68	8 months	M	Dehydration, malnutrition	12 days	None	Striky mucus in middle ear	None	Broncho pneumonia
29 2	8 months	F	Dehydration	21 days	No mastoidectomy, paracentesis	Purulent drainage granulation in ears	None	None
29 5	8 months	F	Broncho pneumonia, empyema	12 days	None	Pus, bilateral	None	Cellulitis of neck
29 6	12 months	M	Asthma broncho pneumonia	21 days	Bilateral mastoidectomy, paracentesis	Thick pus	None	Nephritis
29 7	3 months	M	Broncho pneumonia	7 days	No mastoidectomy, paracentesis	Otitis	None	None
29 8	14 months	F	Feeding case	14 days	Bilateral	Pus in right side	None	Peritonitis following injection of dextrose with punctured intestine
29 9	12 months	M	Broncho-pneumonia, erysipelas from which recovery had been made, pertussis	30 days	None	None	None	Abscess of scalp, septic infarcts in lung, septicemia
29 10	7 years	F	Pharyngitis	21 days	None	Bilateral otitis media	None	Septicemia, multiple abscesses
29 12	10 months	M	Diarrhea	10 days	None	Bilateral mastoiditis	Slight necrosis	Pneumonia
29 13	7 months	M	Dehydration	8 days	None	None	None	Broncho-pneumonia
29 14	10 months	F	Dehydration, diarrhea	30 days	None	Acute purulent infection oftrum and middle ear	None	Measles, pneumonia
29 20	12 months	M	Rickets malnutrition	60 days	Paracentesis no mastoidectomy	Terminal bilateral otitis media and mastoiditis	None	Anemia, scabies
29 21	12 months	M	Feeding case of long standing	210 days	Paracentesis no mastoidectomy	Terminal mastoiditis	Slight	None
29 28	9 months	F	Enteritis	25 days	Paracentesis no mastoidectomy	Acute bilateral otitis and mastoiditis	Slight	Pneumonia
29 30	5 weeks	F	Malnutrition club feet	14 days	None	Bilateral mastoiditis	Slight	Broncho-pneumonia
29 32	2 years	M	Mastoiditis	14 days	Bilateral paracentesis no mastoidectomy	Mastoiditis	Mixed	Pneumococic meningitis

enteric infection, while in the remaining forty almost every common disease of infancy was represented. A large majority of the infants were under 1 year of age and therefore were of an age when complications are frequent. As can be seen the incidence of the ear and mastoid infection was much higher in the nonenteric than in the enteric group. Both gross and histologic examination of these mastoids and

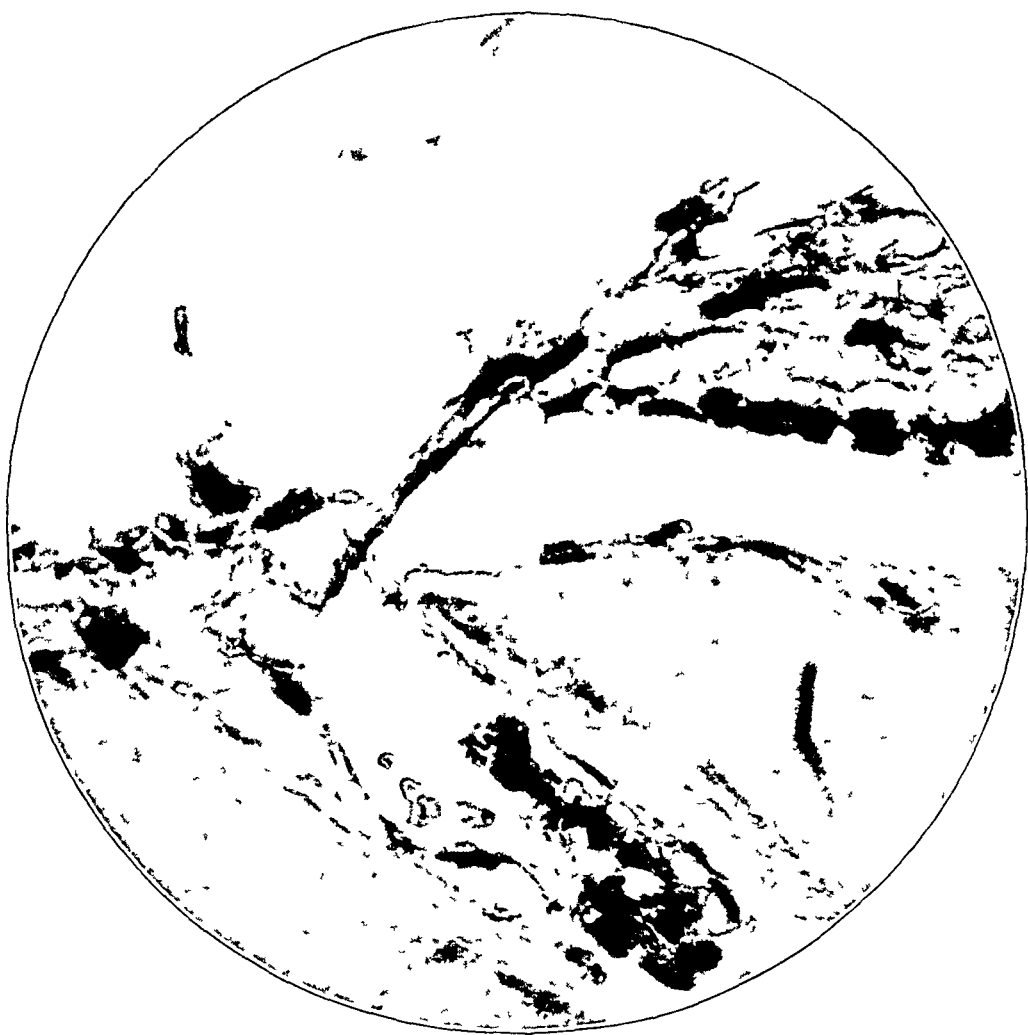


Fig 1—Early mucous type of inflammation in the mastoid, $\times 700$. No bony change is seen, the epithelium is swollen, pus cells are rare and red cells are present. The duration of the primary illness was three weeks.

middle ears showed, in the majority, little evidence of bony necrosis. In the mucus-containing type of mastoid, about all that was found was edema and swelling of the epithelium, although the mucus contained pus cells and organisms. Sometimes, when frank suppuration was encountered we found early bony necrosis but oftener the

bone was intact and the epithelium still present. In fact, the predominant picture was that of a purulent exudate, rich in pus cells, without death of bone. The presence of young connective tissue may readily be misinterpreted, since, in infants, myxomatous tissue and young connective tissue are present in the antrum beneath the mucosa normally.

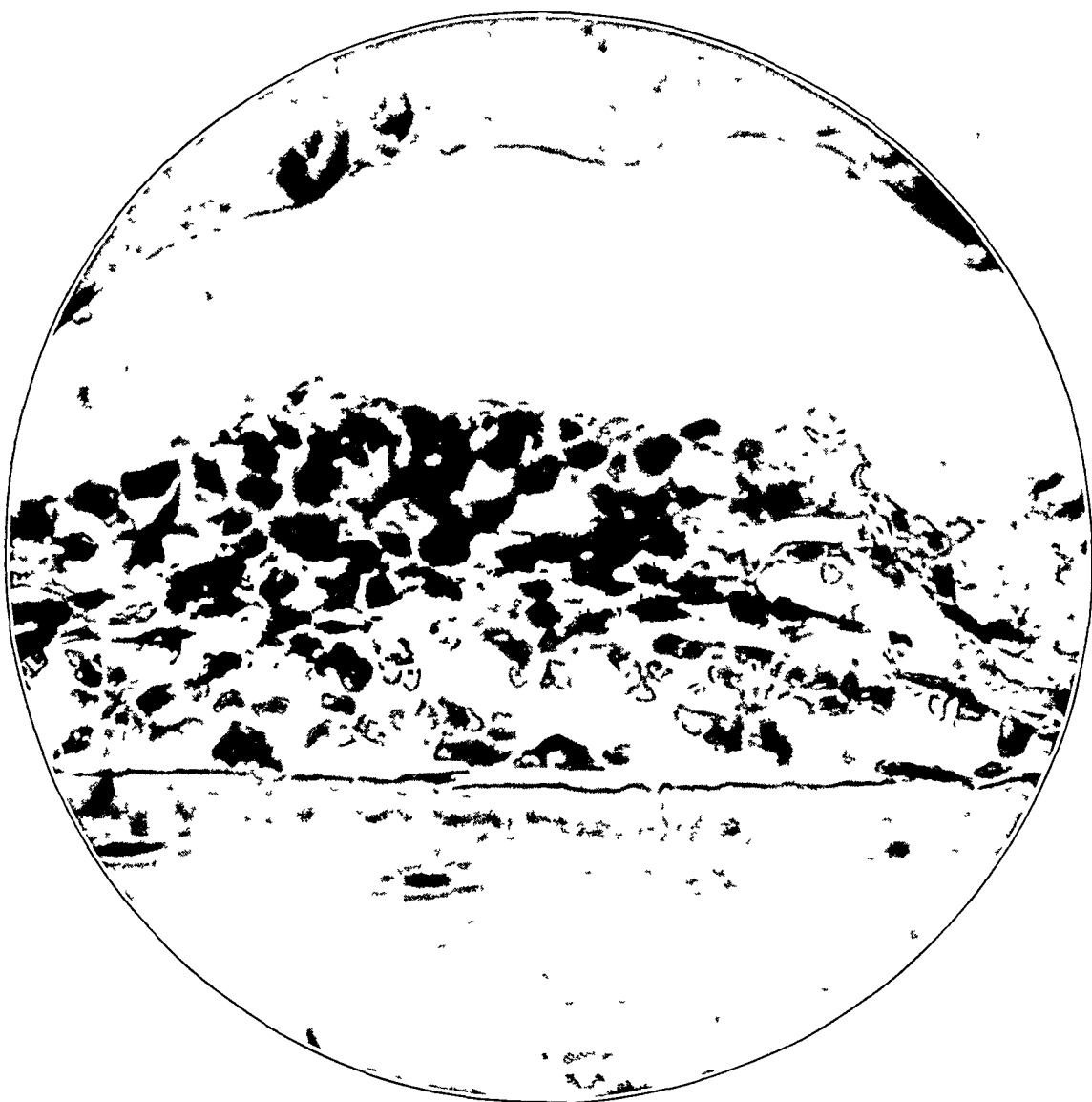


Fig 2—Mastoid showing desquamation of the epithelium and early exudate of pus but no bony change, $\times 700$. The duration of the primary illness was ten days. This represents the most frequent picture.

A careful study has convinced us that the histologic observations fit in rather accurately with the clinical observations. We do not think that the mastoid symptoms preceded the diarrhea-vomiting complex in the cases that we studied, since they resemble identically those found in

the nondiarrheic child. In two cases of the enteric group, both gross and histologic examination of the intestines showed old ulcerative changes in the mucosa. The ear disturbances were both grossly and histologically of brief duration. Only in three cases of the entire fifty-seven could the mastoid infection have been considered as the primary cause of death. In this series of fifty-seven cases, 41.1 per cent of the

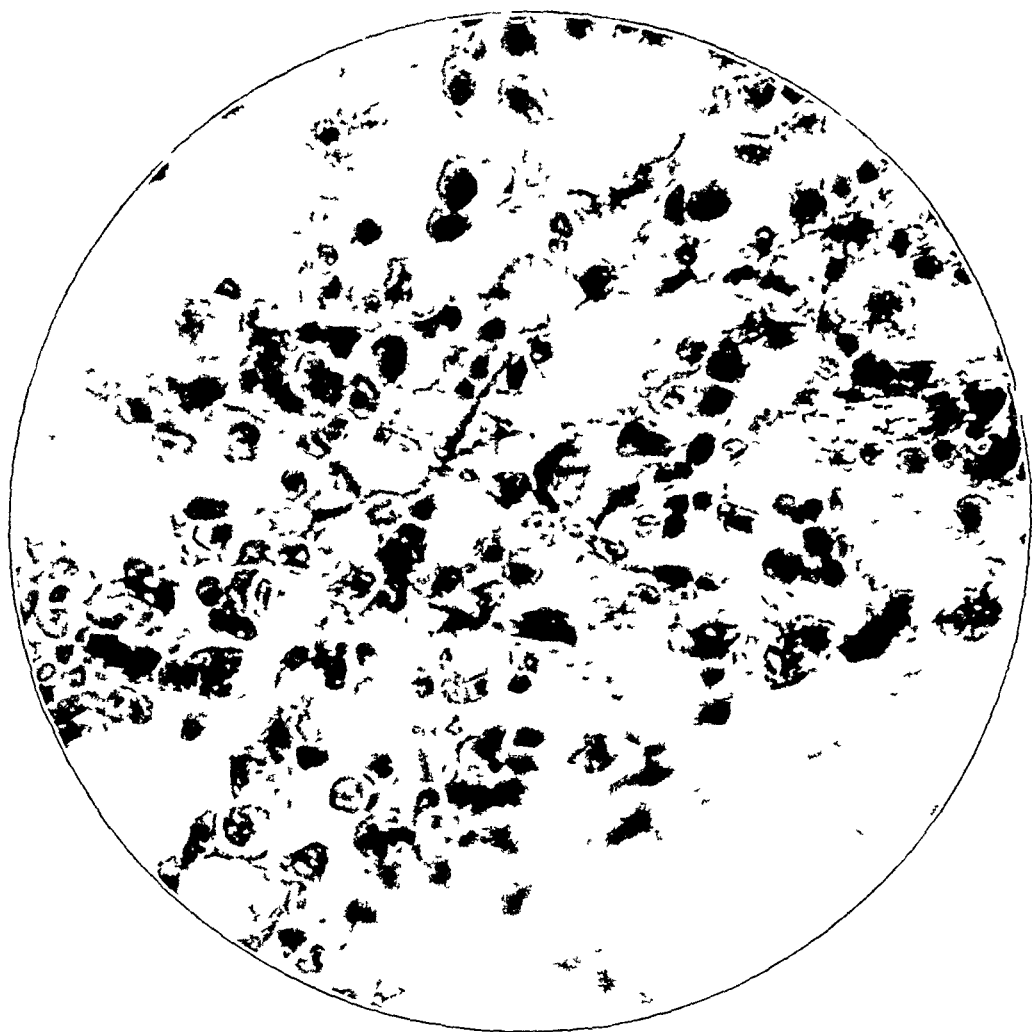


Fig. 3—Mastoid showing purulent exudation and marked epithelial desquamation but no bony change, $\times 700$. The duration of the primary disease was one month.

infants who gave a history of diarrhea died following operation for mastoiditis. The bony changes were either slight or negligible, in most of them. In every case, the history of diarrhea antedated that of the ear infection.

CONCLUSIONS

1 In the usual fatal illnesses of infants, ear infection is a common terminal event

2 Enteritis, as shown by necropsy, too frequently antedates the ear infection for one to assume that the latter is primary

3 The mortality rate of these infants coming to operation was high and distinctly out of proportion to the usual mortality rate

4 From this study we conclude that although surgical mastoiditis does occur in infants its importance has been vastly overrated

CARDIOSPASM¹

CHARLES J. IMPERATORI, M.D.²

NEW YORK

The following names are the various synonyms suggested for cardiospasm: ingluviosis, preventriculosis, achalasia, phrenospasm, hiatal esophagismus and stenosis of the lower end of the esophagus.

ETIOLOGY

Jackson¹ has said that "anatomic, pathologic, fluoroscopic, esophagoscopic and clinical studies have shown that the disease in a large proportion of cases is not spasmodic."

The condition has been considered as a neurosis. McKinney, Guisez, Plummet, Saignon and others have considered it as endocrine imbalance. Mosher has demonstrated by fluoroscopic and anatomic studies that there is some pathologic change in the liver tunnel which causes this condition. He has shown that there are certain cases in which the compression stenosis caused by the liver has produced this phenomenon. In other cases, cicatrices and adhesions were the organic factors of the obstruction. Pathologic conditions of the lower lobe of the left lung have been considered as factors in producing this abnormality. Jackson has demonstrated physiologically that there is a kinking of the abdominal esophagus, and that there is a diaphragmatic pinchcock. The structure of the musculature and the structure and position of the crura seem to constitute the perfect mechanism for pinching shut the esophagus just as a pinchcock in the chemist's laboratory closes the rubber tube.

Cardiospasm may represent the defense against repressed fellatio fantasies. Nausea is a common symptom of some sex perversions, when the latter are repressed. Greig² expressed the belief that there are three factors which exert their influence on cardiospasm. 1 Anatomically, he considered that the esophageal opening of the diaphragm is apparently not modified by movements of the diaphragm and maintains an unvarying diameter. Furthermore, from an anatomic point of view, it is important to realize that the esophagus has in common with the lungs, a parasympathetic nerve supply from the bulbar region in addition to its sympathetic nerve supply. 2 Physiologically, Greig pointed out the necessity of considering the esophagus as equivalent to

¹ Submitted for publication, Nov. 18, 1929.

Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929.

1 Jackson. Cardiospasm, in Nelson's Loose-Leaf Living Medicine, New York, T. Nelson & Sons, 1920, vol. 5, chap. 4, p. 71.

2 Greig. Brit. M. J., September, 1922, p. 470.

other parts of the digestive tract in maintaining constantly a certain degree of tonus. ³ From a pathologic standpoint, a congenital deficiency of primarily the nerve fault involving the sympathetic or parasympathetic nerves, or both, may occur so that the esophagus cannot properly relax. This inability to relax suggested to Hurst ³ the term achalasia, for he regarded this condition as due to a failure in the coordinating mechanism by which the cardiac sphincter usually relaxes as the gullet muscles contract.

Frothingham ⁴ considered that the muscle fibers of the diaphragm may play an important part, and in his opinion no demonstrable disease of the esophagus is necessary to induce cardiospasm.

Logan Turner ⁵ considered the term cardiospasm a misnomer.

Friedenwald and Morrison ⁶ differentiated cardiospasm from spasm of the cardia. Cardiospasm is not only hypertrophy and an unusually strong contraction of the cardia, but there is also a diffuse dilatation of the esophagus. It is most likely to occur in neurotic persons. Spasm of the cardia is a transient condition.

The peristalsis of the esophagus with which every one is familiar is that which follows an act of deglutition (Meltzer ⁷). All the movements of the complicated act of deglutition are managed by a reflex mechanism with only one sensory stimulus for its initiation and a series of consecutive motor impulses going to every part of the long path of deglutition, it is practically a single reflex. The reflex mechanism of the secondary peristalsis, on the other hand, consists of a chain of reflexes, each part of the esophagus sends to the center a sensory impulse started by the presence of the bolus in that part and receives in turn a motor impulse. The secondary peristalsis therefore requires the presence of some sort of a bolus within the esophagus and presupposes the integrity of the latter. Whereas the primary peristalsis requires neither a bolus nor the integrity of the esophagus, even if a large section of the latter is removed, the peristalsis appears in the lower segment in due time after each deglutition as long as the vagus nerves remain intact.

The specific contraction of the rabbit's cardia is characteristic, ⁸ it can even be distinguished from contraction of the adjacent parts of

³ Hurst, quoted by Thomson, St. Clair. *Diseases of the Nose and Throat*, ed. 3, New York, D. Appleton & Company.

⁴ Frothingham, quoted by Cecil. *Textbook of Medicine*, Philadelphia, W. B. Saunders Company, p. 631.

⁵ Turner, Logan. *Nose, Throat and Ear*, ed. 2, New York, William Wood & Company, p. 234.

⁶ Friedenwald, H., and Morrison, T. N. *South M. J.* **16** 34, 1923.

⁷ Meltzer, S. J. Secondary Peristalsis of the Esophagus (*Proc. Soc. Exper. Biol. & Med.* **4** 35, 1907).

⁸ Meltzer, S. J., and Auer, J. Vagus Reflexes upon Esophagus and Cardia, reprinted from *Brit. M. J.* **2** 1806 (Dec. 22) 1906.

the esophagus and stomach. The contractions are seen to follow, in the first place, at the end of a peristaltic movement of the esophagus after complete deglutition. They also occur in a characteristic way after stimulation of the peripheral end of one of the vagus nerves. The behavior of the cardia during stimulation depends largely on the strength of the stimulus.

The mass thrown down is detained in the esophagus above the cardia until the contraction of the lower section of the esophagus begins" (usually about six or seven seconds after beginning deglutition in human beings). Meltzer⁹ stated that in not a single instance was any liquid projected through the cardia into the stomach before the arrival of the peristaltic wave about four seconds (in dogs) after the beginning of the act of deglutition. In anesthetized animals, the first act of deglutition often takes place without being followed by peristalsis. In such an abortive deglutition it is seen how fluid or air is shot down into the esophagus and remains there. At a few such abortive deglutitions followed one another after shorter or longer intervals, the esophagus swelled to a large size looking like a "sausage" until a peristaltic wave set in and carried the entire mass downward all at once. Direct ocular observation of the thoracic esophagus conveyed to me the impression that in the state of rest, the lower part seems to be tonically more contracted than the upper part, and that the upper part is distinctly more responsive to the changes of respiration than the lower part.

As to the depth in the esophagus reached by the immediately projected mass, this depends on the quantity which is swallowed, on the force with which it is thrown down and probably also on the degree of tonicity of the lower portion of the esophagus. In no case did the liquid swallowed immediately reach even the level of the diaphragm, to say nothing of its shooting or oozing through the cardia into the stomach before the arrival of peristalsis. That with each act of deglutition the swallowed mass should remain for a time within the lower portion of the esophagus must from a teleologic point of view appear strange, and might perhaps be brought into causal connection with the "spontaneous" development of such pathologic conditions as dilatation of the esophagus.

A neuromuscular incoordination¹⁰ is the explanation of Rolleston, who called attention to the disease thirty years ago.

Mosher¹¹ said "I have never denied that there were cases due to spasm but I have never recognized one. In my cases the x-ray findings and those obtained through the esophagoscope were those of

9 Meltzer, S. J. *J. Exper. Med.* 5:150, 1897.

10 Thomson, St. Clair. *Diseases of the Nose and Throat*, ed. 3, New York, D. Appleton & Company, p. 649.

11 Mosher, H. P. *Ann. Otol. Rhin. & Laryng.* 36:1127, 1927.

stricture" There were two cases in a series of six that were analyzed, and it was found, both on fluoroscopy and on roentgen examination, that there was an annular stricture of large caliber about an inch above the dome of the diaphragm This would seem to be the place spoken of in the experimental studies of Meltzer when he said that in the normal esophagus there was a lodgment or a stay of the onward progress of the bolus until peristalsis arrived at that point

It is conceded likely that the function of Auerbach's plexus is probably to keep the muscle from being too active or contracting into a hard knot¹² All of these observations (contractions and dilatations due to section of the vagi) have suggested to me the possibility that some of the contracting contractions seen in the spasmodic ileus, infantile pyloric stenosis, cardiospasm, etc., are due, not to an excessive nerve stimulation, but to the absence of it It would seem that because of the difficulty in staining technic the conclusions are unreliable Certain fibers show up well, while others do not, so that negative observations are always doubtful Even positive ones may be confusing and subject to different interpretations Actually, little is known about the function of these plexuses

Ordinarily, the cardia does not seem able to resist the pressure of even a small column of liquid coming from above¹³ According to Cannon and others, the upper end of the stomach and cardia relaxes as the subject swallows Cannon, Carlson, Boyd, Peaacy and others have found that the cutting of the vagi of the neck will produce a temporary spasm of the cardia, and it may be that changes in the vagi are responsible for some of the cardiospasm seen in clinical practice Against this view is the fact that the transient spasm seen after the nerves are cut is generally replaced by marked relaxation of the sphincter As cardiospasm may be present for many years, thirty or more it would seem that these reflexes cannot be maintained as long Also, as one or two dilatations will cure from 60 to 80 per cent of the patients, it appears that the contraction is in the tough submucous coat Many investigators have considered that a large part of the sphincter of the cardia must be due to the contraction of the diaphragmatic fibers surrounding the lower end of the esophagus This now seems improbable because it can be seen with the roentgen ray that the sphincter is generally situated 2 cm below that point Besides Schlippe has pointed out that the diaphragm contracts during the process of vomiting and yet food leaves the stomach Serial roentgenograms of the esophagus taken during vomiting show the cardia remaining open

¹² Alvarez W C The Mechanics of the Digestive Tract ed 2, New York Paul B Hoeber Inc 1928

¹³ Alvarez (footnote 12 page 90)

Between the circular and the longitudinal muscle,¹¹ there is a plexus of nerves by means of which a local nerve mechanism is maintained. Intimate connection with the great nerve centers is had by the vagi, in addition, the sympathetic sends fibers to the stomach.

SYMPTOMATOLOGY

A sense of discomfort, which is more or less constant, vaguely referred to the mediastinal region and sometimes extending to the diaphragm is usually complained of.¹ Actual pain does not occur. There are usually eructations of gas of an unpleasant odor and regurgitation of stale soured food. The general nutrition may be seriously impaired, but in most cases the patients appear fairly well nourished.

According to Vincent of the Mayo Clinic apples, popcorn and cold water give the greatest difficulty in their free passage through the esophagus. Shortness of breath after meals, hiccup, and cough are common symptoms. Epigastric pain is common. The sense of obstruction to the downward passage of food may be experienced early and usually without regurgitation. Later, definite regurgitation of food is the rule. Loss of weight is not usual.

The symptoms are of shorter duration in malignant stenosis. Solids rather than liquids occasion distress, and there is an associated cachexia and loss of weight. A differential diagnosis must be made from malignant disease, esophageal stenosis (syphilitic), diverticula and even gall-stone colic.

DIAGNOSIS

The diagnosis is made by the roentgenologist.¹ The roentgenogram shows a diffuse dilatation of the esophagus, with a stenosis at the diaphragm, the shadow of the opaque mixture narrowing to an irregular trickle through the abdominal esophagus. To quote from Jackson, a typical esophageal picture is a widely dilated esophagus with a grayish-white, pasty mucosa looking like a furred tongue, as in the case of the latter, the coating cannot be wiped away. At the bottom of the sac is a white "floor" of wrinkled esophageal wall through which a firm resistance of the diaphragm can be felt. Knowing the required direction of the tube (pointing to the anterior superior spine of the left ileum), the examiner searches for the hiatus, when it is found, the resistance to the advance of the esophagoscope is discovered to be no more than normal. The instrument passes into the stomach without resistance. The absence of a growth or an infiltration, such as a cancer, completes the diagnosis. In a true cardiospasm, the roentgenogram is usually sufficiently characteristic, revealing a conical dilatation of the terminal of the esophagus above the cardia.

¹¹ Osler, William and McCrae, Thomas. *Modern Medicine*, Philadelphia, Lea & Febiger, vol. 3, p. 307.

The outline is smooth and symmetrical as distinguished from carcinoma in which the stenosis is usually well above that point

A Mosher ballooning esophagoscope facilitates the diagnosis, for by gentle inflation the mucosa can be pushed away from the beak of the instrument, and as one approaches the cardia, the direction of the esophagus and the position of the cardia are more easily made out, even though a spasm is taking place, by again gently ballooning the beak of the instrument, it enters further and eventually reaches the stomach

In the differential diagnosis, it is essential that one establish the integrity of the mucosa. In cardiospasm, the mucosa may be irritated, congested and coated with a glary mucous of a thick milky-like substance, whereas, of course, in a malignant condition there is a loss of continuity of the mucous membrane by either a new growth or an ulceration of this growth. In diverticulum, diagnosis is positively made by the roentgenogram and would be necessarily of the traction type. The pulsion diverticulum, of course, would be located in the upper part of the esophagus in the cricopharyngeal region and would show by roentgenogram, in esophagoscopy, difficulty would be experienced in entering the lower part of the esophagus. Diseases of the gallbladder and other abdominal conditions might even produce a cardiospasm, reflexly, and the pain might be referred to the epigastric region, but other symptoms such as colic definitely referred to the region of the appendix or gallbladder, roentgenograms definitely showing some lesion in these regions and other gastro-intestinal symptoms would indicate that one was dealing with some condition other than that of a true cardiospasm

TREATMENT

When the case under consideration is one of so-called cardiospasm, after esophagoscopy has been performed and has confirmed the roentgenographic observations, there is but one treatment that is of real value and that will, in from 60 to 80 per cent of the patients presenting themselves, give more or less permanent relief. I refer to dilatation of the cardia. This dilatation should be at least the size of the upper part of the esophagus and, better, one larger than that. Hydrostatic dilatation as suggested by Plummer and Vincent, and the suggestion of Mosher of using a barium sulphate mixture instead of water have been used successfully

The method of procedure is as follows

With an instrument that is a combination of the Mosher diagnostic barium bougie and the Plummer hydrostatic dilator the thin barium mixture is introduced into the bag. The proper pressure is maintained by a manometer which should register from 15 to 25 pounds (6.8 to 11.3 Kg.) depending on the character of the case and the size and the

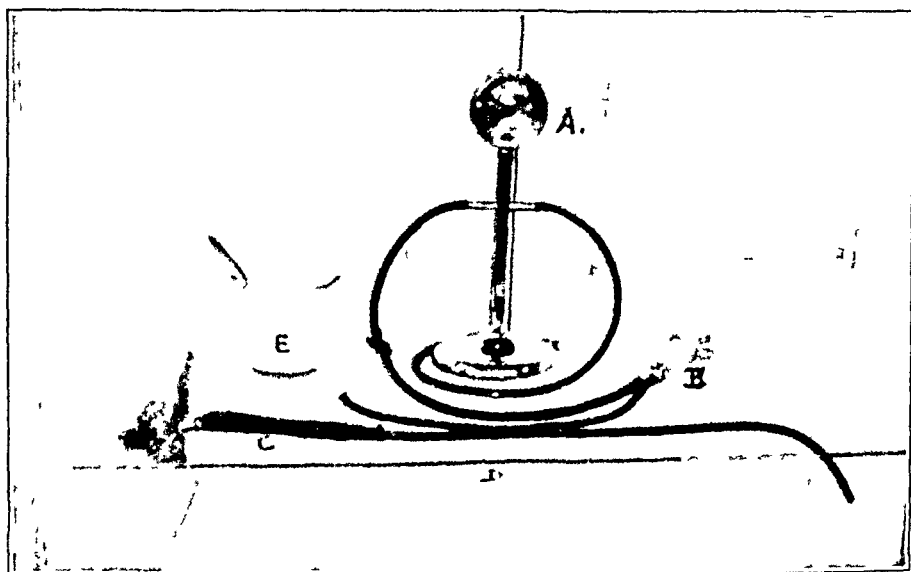


Fig 1—1 Plummer manometer with radiolite dial *B*, Potam syringe, *C* Plummer hydrostatic dilator *D*, removal stilet (after Moshier) to facilitate the introduction of the dilator, *E* jar containing barium mixture



Fig 2—Hydrostatic dilator within the cardia, before dilatation

age of the patient. The method of introduction of the fluid is by a Potain pump, the connections being reversed, that is, instead of aspiration the fluid is introduced and the column is maintained in the tube because of the valve action of the Potain pump. The patient is placed in the fluoroscope, and the Plummer-Mosher instrument is introduced under its guidance. When the hydrostatic bag is seen in the midportion of the cardia, the fluid is pumped into it. This is continued until a pressure of from 18 to 24 pounds (8.2 to 10.9 Kg.) is obtained. There should

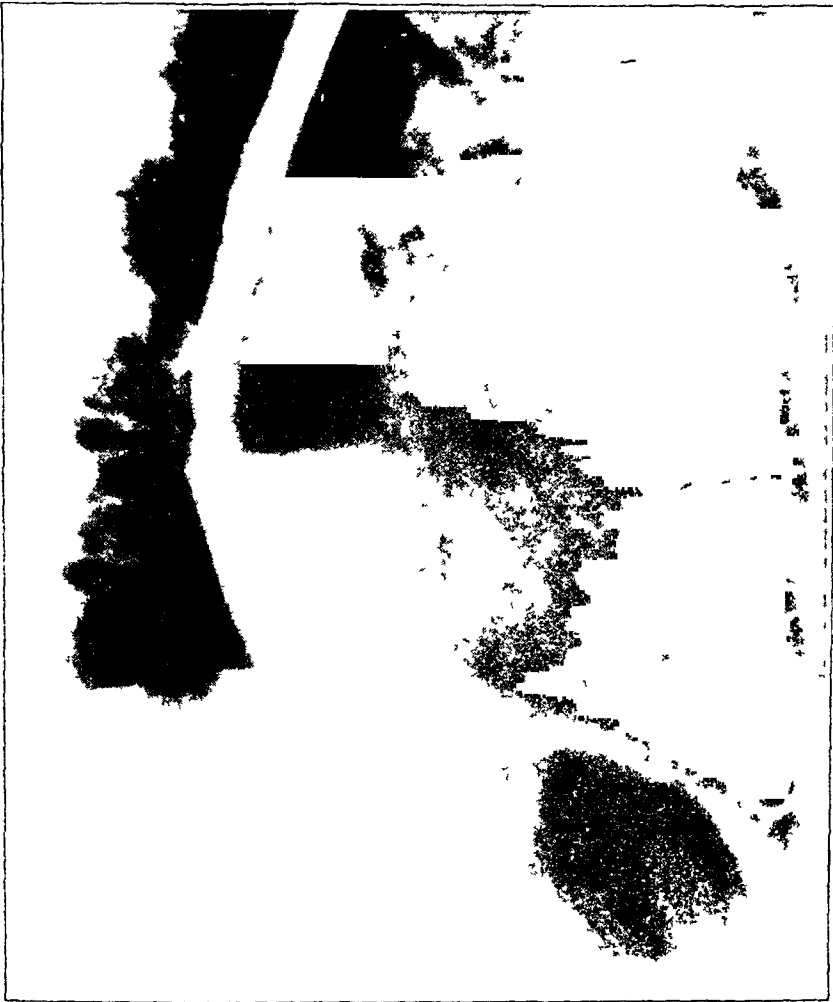


Fig. 3—Dilatation of the cardia, showing the waistlike constriction of the dilator where it is grasped by the cardia.

be a sustained pressure of from two to five minutes. Usually and immediately following the dilatation, burning pain is experienced in the epigastrium. This may persist for several hours or until the next day. During the dilatation the hydrostatic bag is seen in the cardia with the olive or the flexible tip in the stomach near the greater curvature, toward the left side of the patient. The general outline of the bag is that of a bulge below, with a tapering to the midportion and a bulge above; in other words the bag assumes at its midportion a waistlike outline.

This outline depends on the amount of dilatation that the cardia is subjected to. At no time has the bag been seen to be entirely without a constriction of its midportion. After the pressure is maintained for from two to five minutes, the fluid is removed by the releasing of the pump from the tubing of the end of the dilator, and the tube and the bag are removed from the esophagus. Usually there will be a great deal of gray and viscid mucous withdrawn with the bag. As a rule, roentgenograms taken immediately following this procedure show exactly

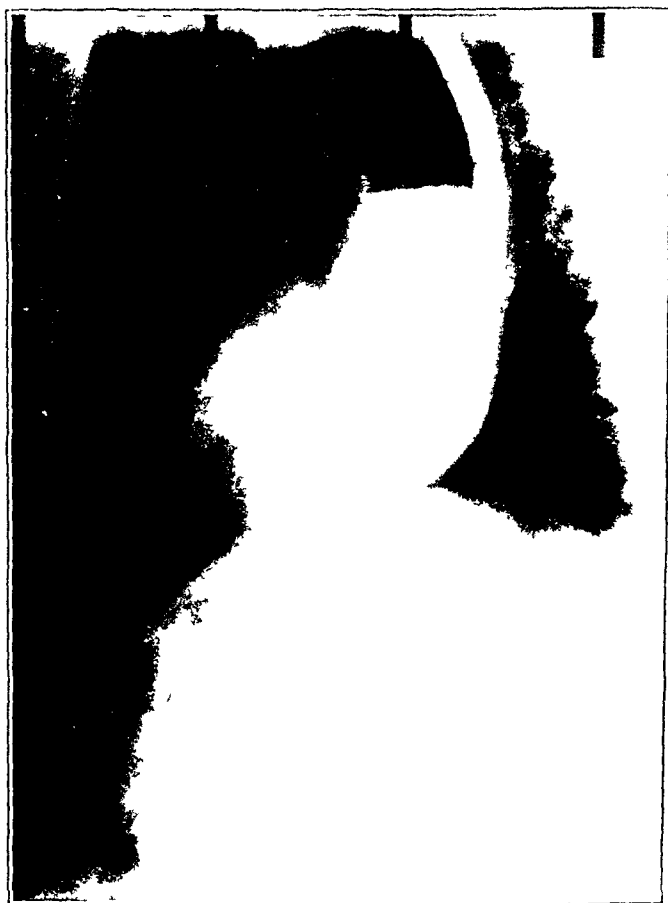


Fig. 4—Dilator within the esophagus, it has slipped out of the cardia. This shows the necessity of proper fluoroscopic supervision of the instrument during dilatation.

the same condition that existed prior to dilatation. These phenomena would appear paradoxical, for these patients are able to eat immediately without the former symptoms, and they gain weight rapidly. If the dilatation is not sufficient, recurrence may be expected to follow immediately, and the dilatation should be repeated within a week or ten days, more pressure being used and the dilatation being sustained somewhat longer.

CONCLUSIONS

The roentgenographic study of the cardia following dilatation would seem to prove that one is dealing, not with a spasm, but with a peculiar disturbance of the nerve endings in the lower end of the esophagus. From a clinical standpoint, Meltzer's laboratory experiments would seem to be sustained.

CHANGES IN THE ESOPHAGUS SECONDARY TO CARDIAC AND AORTIC DISEASES*

L. RIGLER, M.D.
AND
K. A. PHELPS, M.D.
MINNEAPOLIS

The importance of changes in the esophagus produced by diseases of the heart and aorta is being recognized more and more by roentgenologists and cardiologists throughout the world. Roentgen examination of the esophagus in such cases is often of considerable value as a diagnostic aid in determining the condition of the heart or

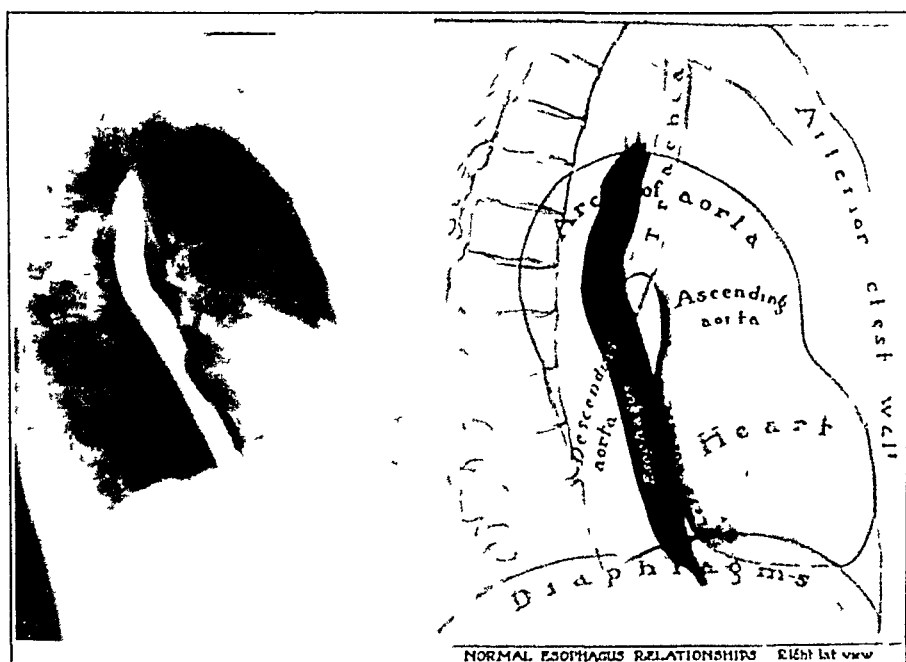


Fig 1—A, the aortic bed in the esophagus and the cardiac compression are well shown, notice the space between the vertebral column and the lower portion of the esophagus, this is normally occupied by the descending aorta, B, the bifurcation of the trachea is not shown

aorta. Most of these patients have no esophageal symptoms and esophagoscopy is usually contraindicated, still this paper is presented in the belief that it may be of interest and perhaps of some practical value.

The normal relationships of the esophagus to the heart and aorta are shown in figure 1. The diagram is made from the x-ray film to

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Figure 2

Fig 2—The corrugated tube in the esophagus differentiates that structure from the large blood vessels which have been injected by the embalmer's fluid. Note how the arch of the aorta passes in front of the esophagus and then loops around it so as to descend posteriorly and to the left of it. This is the first time that this plate has been shown (kindness Dr. Rigler)



Figure 3

Fig 3—A large aneurysm of the aortic arch. The esophagus is displaced to the right and a sharp kink is made in it, nearly a half circle must be made by food going around the aorta.

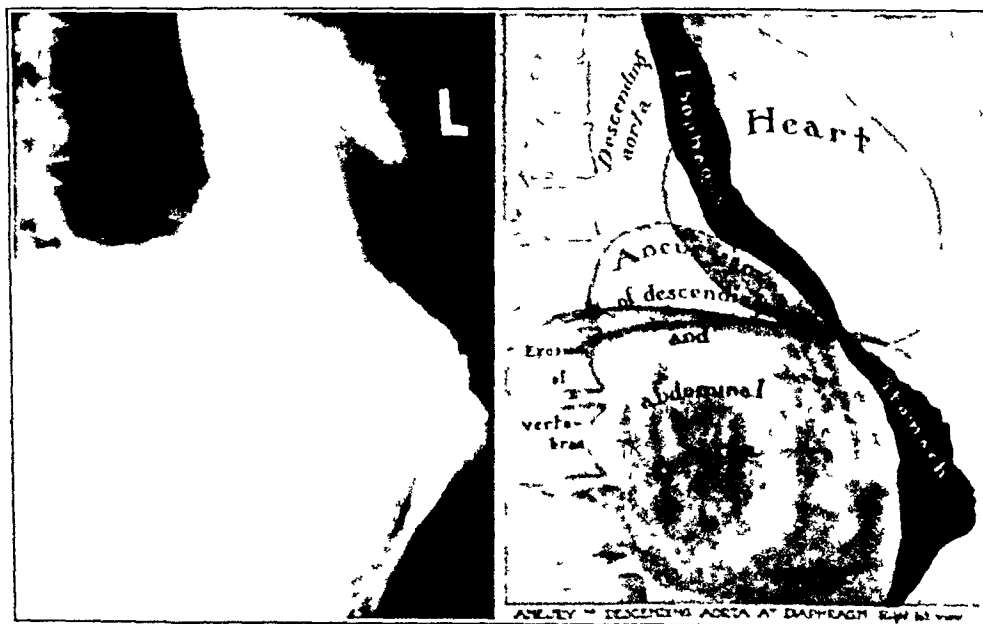


Fig 4—A large aneurysm of the descending and abdominal aorta displacing the esophagus anteriorly.

interpret its reading better. The anterior wall of the upper third of the esophagus is crossed by the transverse portion of the arch of the aorta, producing what esophagoscopists know as the aortic narrowing. Just below this is the narrowing produced by the left bronchus. From this point the anterior esophageal wall is in contact with the left auricle of the heart, which extends nearly to the level of the diaphragm, and the left posterior esophageal wall is in contact with the descending aorta till just above the diaphragm the esophagus turns to the left and crosses the aorta, there the right posterior wall is in contact with the aorta. Figure 2 is a plate made of a cadaver after the embalmer has injected the internal carotid artery with a solution of lead oxide. A

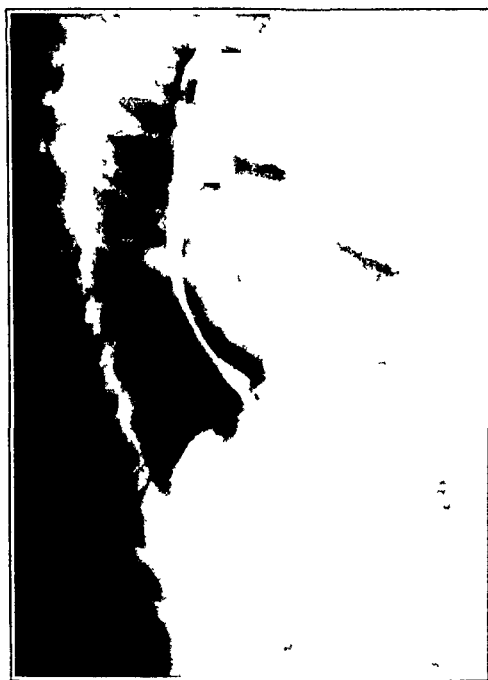


Fig 5—Marked compression of the esophagus and displacement posteriorly by an enlarged left auricle. Here the esophagus seems to be posterior to the anterior border of the vertebral column. This patient complained of esophageal obstruction.

corrugated tube has been inserted into the esophagus. One can see how the arch of the aorta crosses the esophagus and passes down, as the descending portion, posterior and to the left of the esophagus.

This close anatomic relationship has been taken advantage of by clinicians who have percussed the posterior wall of the heart and auscultated the left auricle by means of tubes and tambours in the esophagus. Rigler¹ noted the infrequency of reference in the roentgen literature to the value of roentgen examination of the esophagus in

1 Rigler. Visualized Esophagus in the Diagnosis of Diseases of Heart and Aorta, *Am J Roentgenol* 21 563, 1929.

cardiac cases. He discussed the technic of making the roentgen examination together with its value to the cardiologist as a diagnostic aid. From the standpoint of endoscopy his conclusions may be given as follows:

1 Dilatation of the aortic arch will produce a deviation of the esophagus to the right posteriorly with compression (fig. 3)

2 Dilatation of the descending aorta displaces the esophagus anteriorly and produces compression. If in the proximal three-fourths, the esophagus is displaced to the right and if in the distal fourth, it may be displaced to the left (fig. 4)

3 Dilatation of the left auricle compresses the esophagus and displaces it posteriorly (fig. 5). That cardiac enlargement is a cause of esophageal obstruction is not commonly mentioned in the literature on the esophagus. In Abel's new book on esophageal obstruction, for instance, this fact is not mentioned. Of course, patients with hearts dilated sufficiently to produce esophageal compression are usually so sick that they do not complain much of their esophageal symptoms.

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY

BRONCHOSCOPIC CONSIDERATIONS *

LOUIS H. CLERF, M.D.

PHILADELPHIA

The increasing number of reports of successful treatment by bronchoscopy in cases of pulmonary abscess confirms the observations of the earlier bronchoscopists regarding the wisdom of improving drainage by way of the natural channels. Experiences at the bronchoscopic clinics have convinced the bronchoscopist, as well as the internists, roentgenologists and surgeons who see the cases of abscess of the lung in consultation that in a majority of instances bronchoscopy should be given a trial unless definitely contraindicated.

Since reporting on certain observations and results¹ in a group of cases, additional patients with abscess of the lung have come under my care, so that now a series of seventy-seven cases is reviewed.

OBSERVATIONS

The curious frequency of occurrence of pulmonary abscess complicating tonsillectomy in early adult life remains unchanged. Of the seventy-seven cases, fifty (65 per cent) occurred in patients between the ages of 20 and 40. This corresponds rather closely to the age-abscess incidence of pulmonary abscess from all cases as shown by Flick and his co-workers². In their report on a series of 172 cases of abscess complicating operations, respiratory infections and other conditions, 58.7 per cent occurred in patients between 20 and 40.

Anesthesia—In four cases, local anesthetic was used, in seventy-three, general anesthesia (table 1). This is of significance when it is recalled that local anesthesia is more often employed for tonsillectomy during the third and fourth decades, and it is among patients in this period of life that abscess most commonly occurs.

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* Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929.

1. Clerf, Louis H. Lung Abscess Following Tonsillectomy, *Atlantic M. J.* **31** 911 (Sept.) 1928.

2. Flick, J. B., Clerf, L. H., Funk, E. H. and Farrell, J. T. Pulmonary Abscess, *Tr. Am. A. Thoracic Surgeons*, 1929, *Arch. Surg.* **19** 1292 (Dec.) 1929.

Lobar Distribution—The present observations conform with those of the majority of writers so far as involvement of the right lung is concerned. In forty-eight cases (62 per cent) the right lung was involved, while in twenty-eight (37 per cent) the abscess occurred in the left lung, in one the lesion was bilateral. In lobar involvement, however, the distribution is at variance with the observations of many observers. As will be noted in table 2, an upper lobe was the site of

TABLE 1—*Frequency of Pulmonary Abscess Complicating Tonsillectomy*

Decade of Life	Per Cent
First	10
Second	16
Third	37
Fourth	28
Fifth	7
After fifth	1
Sex	
Males	53.2
Females	46.8
Anesthesia	
Local	4 cases
General	73 cases

TABLE 2—*Lobar Distribution of Abscess*

Monolobar lesions	
Right upper	23
Middle	2
Right lower	13
Left upper	13
Left lower	11
Total	62
Multilobar lesions	
Right upper and middle	3
Middle and right lower	7
Left upper and left lower	4
Right upper and middle and left upper	1
Total	15

the lesion in thirty-six cases (46.7 per cent). With the middle lobe included as a part of the right upper lobe, the number of cases in which the upper lobes are involved is forty-two (54.5 per cent). The cause of this statistical discrepancy is not apparent. In this group, localization of the lesion was based on physical examination, roentgen study and bronchoscopic observations, and represents the most accurate method that can possibly be employed in the living subject without resorting to surgical exploration. One is often impressed with the difficulty in ascertaining the lobar distribution of a deep-seated abscess by physical examination alone. Usually after a complete study one can be certain of the lobe involved.

DIAGNOSIS

A history of tonsillectomy followed by symptoms and signs of a suppurating process in the lung is suggestive of postoperative pulmonary abscess. As frequently pointed out by Jackson, Yankau, Patterson, Imperator, and others, the presence of a bronchial foreign body must be considered and ruled out. Other bronchial lesions may be present and may not manifest symptoms until some time after a tonsillectomy or other operation has been done. The following case is illustrative.

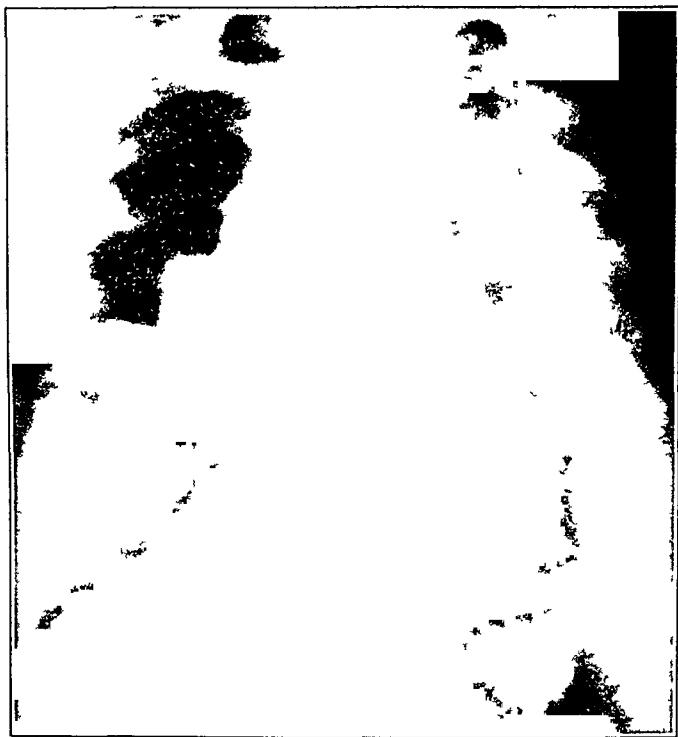


Fig 1—The pathologic process involving the root area of the right lung is extensive, the outlines are so sharply defined that if of infectious origin the process must be of long duration. Dr W F Manges expressed his belief that the lesion may be a new growth which is probably encapsulated rather than infiltrating (roentgenogram by Dr Manges).

A man, aged 36, who had had sore throat and was below par physically, was advised to have the tonsils removed. Tonsillectomy was performed under general anesthesia. Convalescence from the operation was delayed. Within three weeks after operation there developed an unproductive cough with pain in the right side of the chest. In a few days pus, at times blood-stained, was expectorated. A diagnosis of abscess of the lung complicating tonsillectomy was made and appropriate medical treatment was instituted. For about one month no improvement was noted, and the patient was referred to the Bronchoscopic Clinic for treatment. Dr E H Funk's observations by physical examination indicated a well localized lesion in the right lung and were suggestive of abscess although new growth could not be ruled out. Bronchoscopy was indicated. The roentgen

studies were reported by Dr W L Manges (fig 1). At bronchoscopy there was found a stenosis of the right bronchus produced by a neoplasm. A specimen was removed for histologic examination. Dr B L Crawford's report was carcinoma.

Without a diagnostic bronchoscopy in this case, the diagnosis would probably have been abscess of the lung until surgical intervention or metastasis of the growth would have furnished the necessary additional information.

TREATMENT

The underlying principles in the treatment for pulmonary abscess, irrespective of the method to be employed, consist of establishing and maintaining adequate drainage. There are other considerations, but this one is fundamental. If this can be accomplished, under a regimen of rest and postural drainage combined with symptomatic measures, no other forms of treatment are indicated, if drainage cannot be adequately maintained, additional aids are necessary.

Bronchoscopy, in safe hands, is generally admitted to be an aid in the conservative form of treatment in contradistinction to external drainage, the more radical form. When should bronchoscopic treatment be instituted? There is considerable difference of opinion with regard to this question. Some writers favor treatment early in the course of the disease, while others advocate delay to determine whether the patient will recover under medical treatment alone. The latter plan may be of controversial interest in ascertaining the number of cases of pulmonary abscess in which the patient will recover spontaneously. It affords little comfort, however, to the patient who does not recover and whose case must now be classed as chronic. Bronchoscopy is indicated if drainage is impaired. It may be difficult to decide whether the symptoms in a given case are due to an extension of the suppurative process or to interference with drainage. Here it is important to have the counsel of the internist and the roentgenologist. Fever is no contra-indication to bronchoscopy, often, following one or two aspirations, the temperature will return to normal (figs 2 and 3).

It has been the practice at the Chevalier Jackson bronchoscopic clinics to institute bronchoscopy early in the course of the disease. It must be recalled that a majority of the patients referred to the clinic have been under medical treatment for variable periods of time, and, owing to little or no improvement, it was concluded that bronchoscopy was indicated. If external surgical drainage is indicated a diagnostic bronchoscopy only is performed. Occasionally there is no apparent indication for bronchoscopy, and the patient is continued under medical treatment. The patients are under the supervision of the internist, and the surgeon is called in consultation to determine whether bronchoscopy

should be continued or whether surgical measures are indicated. Frequent roentgen examinations are made.

No definite rules can be laid down with regard to the length of time that bronchoscopy should be continued before external drainage is employed. Often, patients will not submit to an operation.

Prolonged duration of a pulmonary abscess is not necessarily a contraindication to bronchoscopy. In six of the cases in this group, the duration of the abscess was longer than one year. Of these patients five recovered under medical and bronchoscopic treatment (fig. 4), one



Fig. 2—On the tenth day following tonsillectomy under general anesthesia, a boy, aged 10, developed fever and cough, later a large quantity of fetid pus was expectorated. Dr. W. F. Manges reported from the roentgenogram that an abscess was present in the lower portion of the right upper lobe which extended from the root area to the lateral chest wall. There was an irregular cavity in the interior of the dense area with a large amount of exudate throughout the lung tissue in this area. Fever and cough with expectoration continued. Bronchoscopy was performed five weeks after the onset of symptoms.

case was referred to the surgeon. Every case must be considered individually, in this connection, it is important to emphasize again the need of frequent consultation between the internist, surgeon, roentgenologist and bronchoscopist to determine the best form of treatment. Frequent examination of the patient by the surgeon is important even if operation is not contemplated.

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JEFFERSON HOSPITAL

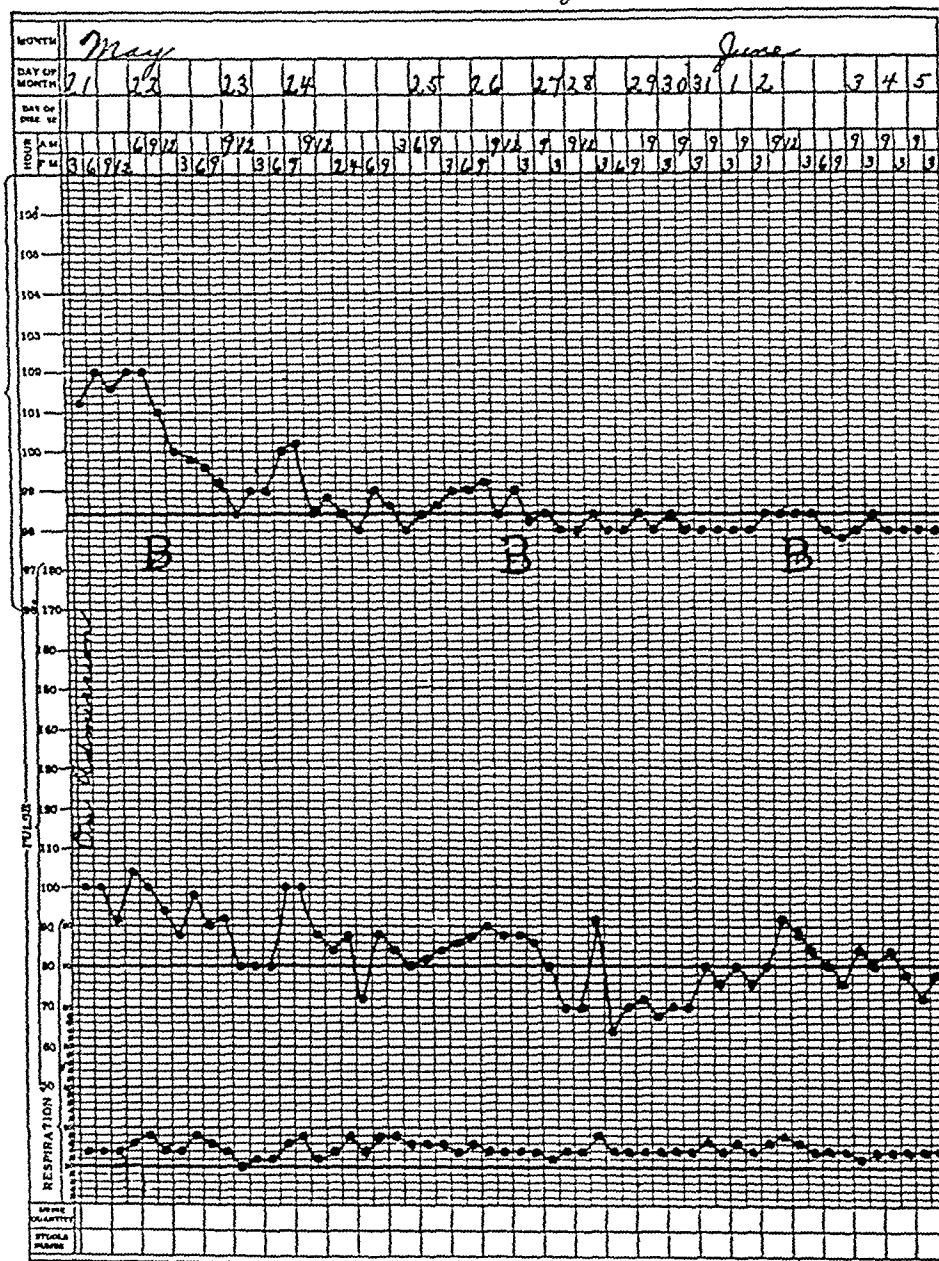
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Fig 3—Following bronchoscopy (B) in patient shown in figure 2, the temperature dropped to normal and remained at that level. Although there was a marked decrease in cough and expectoration, bronchoscopic aspiration was continued. Six bronchoscopic aspirations were performed over a period of seven weeks. At the end of this time the patient was free from all symptoms; no abnormal physical signs were elicited and the roentgen studies failed to reveal any abnormal observations. When last observed over one year after the last bronchoscopy, the patient was well.

A brief summary of the results of treatment in the series of seventy-seven cases appears in table 3. Thirty-eight patients were ultimately discharged as well after a course of bronchoscopic treatment. The average duration of the abscess before treatment was instituted was four and one-half months. In twenty-seven cases, the duration was three months or less, in five cases it was more than one year. The average number of bronchoscopic treatments in the thirty-eight cases was sixteen.



Fig 4—A roentgenogram of a boy, aged 9, who had developed an abscess of the right lung following tonsillectomy fourteen months before. For more than one year he had been receiving medical treatment for a chronic cough associated with expectoration of a small quantity of fetid pus. At times there was fever. The patient was pale and underweight, the breath was fetid. There was slight clubbing of the fingertips. The abscess involved the hilus of the right lung and extended into the upper portion of the middle lobe as well as the lower part of the right upper lobe. Bronchoscopic treatment, which was instituted fourteen months after the development of pulmonary symptoms, was continued over a period of two years, a total of thirty-eight treatments was given. Since the last treatment, which was given three and one-half years ago, the patient has been frequently observed, there has been no recurrence of the suppurating process and he appears well (roentgenogram by Dr W. F. Manges).

In the six cases listed as unimproved, the patients either refused to continue with bronchoscopic treatment, did not return for continuation of treatment or were referred to the surgeon but refused to submit to operation.

Eighteen cases were referred to the surgeon after a brief course of bronchoscopy. The average duration of the infection, before bronchoscopy was instituted, was seven months. In eleven cases the duration was three months or less, in one case it was more than one year. In fifteen cases an average of seven bronchoscopic aspirations was carried out before being referred to the surgeon. In two cases, there was a reinfection after the patients had been discharged from the hospital. In one case, bronchoscopy was carried out in conjunction with surgical intervention.

TABLE 3—*Results After Bronchoscopic Treatment*

Patient	No
Well	38
Improved	7
Unimproved	6
Referred to surgeon	18
Died	3
Under treatment	5

CONCLUSIONS

1 Bronchoscopy is indicated as a diagnostic measure in every case of pulmonary abscess in which there is a question in diagnosis.

2 Bronchoscopic aspiration, as a part of the conservative form of treatment, should be instituted early in the disease unless contraindicated, in the hands of an experienced bronchoscopist contraindications are few.

3 No definite rules can be laid down with regard to the length of time bronchoscopy should be continued, every case of abscess of the lung should be individually considered by the internist, roentgenologist, surgeon and bronchoscopist to determine the form of treatment to be employed.

128 South Tenth Street

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY

LARYNGOLOGIC ASPECT *

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The literature concerning infection of the lung following operative procedures has increased much more rapidly since the bronchoscope has become a recognized instrument of diagnosis as well as of treatment.

Postoperative pneumonias such as those seen a decade or two ago are not frequently seen today, which may be due partly to increased knowledge and to improved technic in administering anesthetics although to my mind this is not all.

The necessity of the respiratory tract to life was known in ancient times, for the first that one reads of man as a living creature relates to his breath. "And the Lord God formed man of the dust of the ground, and breathed into his nostrils the breath of life and man became a living soul."

At what period in the development of medical knowledge was infection of the lung recognized as being derived from the upper respiratory tract? Aristotle (384-322 B. C.) apparently knew the route taken by the air from the nostrils to the lungs, for he described the larynx as the organ through which the voice and breath pass. He furthermore described the trachea and its cartilaginous rings, and said that if liquid is drawn into it, it is expelled through the nostrils. He described the epiglottis as that organ which covers the larynx, but which is supposed to be a part of the tongue. He also believed that voice production was due to the air column in the trachea coming in contact with laryngeal structures.

Both Galen and Paulus Aegineta warned their readers against removing too much tonsil because of the possibility of injuring the voice and causing inflammation of the lungs. From this one has refutation of the arguments of the advocates of both local and general anesthesia, because they used neither. Joannides gave Hippocrates credit, but the reference was incomplete. While they probably did not recognize abscesses of the lung, they knew much of the technic that is used today, and would possibly have equaled workers of today if they had had modern facilities. This statement applies almost equally to immediate pre-roentgenologic and pre-bronchoscopic medical

* Submitted for publication, Nov. 18, 1929.

* Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929.

practice Textbooks on diseases of the nose and throat give little attention to this subject McKenzie gave only the following

Recently, in America, attention has been drawn to the occurrence of the highly dangerous complication of pulmonary abscess and gangrene after tonsillectomy All cases recorded have been adults, in most of whom general anaesthesia had been employed The pulmonary infection is attributed, not to aspiration during operation, but to infective emboli from a septic throat wound, and stress is laid upon faulty technique, with slow operating and unnecessary crushing of tissues, as the chief predisposing cause

This is the opinion of America's best friend in Europe, one who is familiar with and gives credit to our workers whenever deserved but it is, one must admit, very meager considering the importance of the subject McClae gave the following, which was abstracted from Osler

Suppuration appears in the lungs under the following conditions (1) As a sequence of inflammation, either lobar or lobular In lobar pneumonia the abscesses are small and usually involve, as Addison remarked, several points at the same time Abscess formation is frequent in the deglutition and aspiration forms of bronchopneumonia (2) After wounds of the neck or operations on the throat particularly the tonsils, in suppurative disease of the nose or larynx, occasionally of the ear, infective particles reach the bronchi and excite inflammation which often ends in abscess Abscess of the lung after tonsillectomy occurs with alarming frequency Moore, as the result of a careful study, estimated its occurrence as one in from 2,500 to 3,000 tonsillectomies, which is probably conservative The abscess may follow inspiration, as suggested by the fact that 60 per cent are in the lower lobe (41 per cent in the right lung and 19 per cent in the left lung in Moore's series of 202 cases) Others hold that embolism is the chief cause, emboli lodge in the right lung more often than in the left

THEORIES OF ORIGIN

In favor of the embolic theory, one must note the cases of abscess of the brain as well as of the lung, reported by Bevan following tonsillectomy

While one cannot deny the possibility of the occasional embolic transference of septic material from the mouth, nose or throat to the lungs, it is certainly unusual When one considers the number of foreign bodies which gain entrance to the bronchi during waking hours and the entrance of fluids into the trachea during consciousness when the laryngeal reflexes are active, it seems entirely reasonable that infectious material which may be macroscopic or microscopic is probably, if not constantly, passing these barriers during anaesthesia when these reflexes are partially or wholly abolished It is only to be considered miraculous that it does not happen more frequently

Lynch examined tracheotomized patients after tonsillectomy and found blood in the trachea in all cases Myerson performed bron-

choscopy in a large series (200) of otherwise normal children, in 155 of whom he found blood in the trachea

Any patient who is operated on under a general anesthetic, in whose upper respiratory or digestive tract septic material is present, is a potential case of lung abscess, while in those cases in which the operative field is in the mouth, nose or pharynx one may add the possibility that blood clots carry the infection

The origin of the infection has been a bone of contention since Richardson first called attention to the subject, and whether the solution is nearer at present is a question. Observation would lead one to the conclusion that no one source or one lesion is responsible for all cases, because there would be many more cases. Most likely injury is produced by one organism, or its toxins, and another symbiotic organism produces suppuration, or a lodgment in or production of an atelectatic area favors growth of the suppurative organism on a field normally well ventilated. Thus deprived of air, but irritated by saprophytic organisms or enzymes produced by changed dead tissue (blood clot) the organism receives no nutriment from the living organism. Experimental as well as practical evidence can be found in the current literature, and recently experiments have been carried on abroad, especially by Ascoli, which corroborate the aspiratory theory.

Ascoli spoke of his work as "experimental postoperative bronchopulmonitis." From this second series of researches (on dogs) he concluded that in normal lungs it is possible to provoke inflammations of a mild type that tend to resolve and do not give rise to septicemia, even with a strain of pneumococcus of low virulence. The quantity of broth culture injected into the respiratory passages must always be about 20 cc, it must be injected directly into the bronchi with a sound introduced through the natural passages. The author felt justified in affirming also that while it is possible with a slightly virulent pneumococcus to produce mild inflammations of the lungs of normal dogs by the use of a definite technic and a definite quantity of septic material, it is not possible by injecting a smaller quantity of broth culture directly into the trachea through the skin. Four controls thus treated all showed normal lungs. However, dogs subjected to simple gastro-enterostomy showed, in three of eight cases, pulmonary lesions comparable to those obtained by American investigators.

While it is known that the epiglottis does not cover the larynx during deglutition, but with the assistance of the base of the tongue forces the bolus into the sides of the pharynx, and that food and foreign bodies do not gain entrance to the larynx, even when the epiglottis is destroyed by disease nevertheless, during operations on the throat and mouth the pressure on the base of the tongue has a tendency to keep

the epiglottis upright and the larynx open but slightly narrowed on account of the tension on the aryepiglottic folds and ventricular bands

The size of the lumen of the larynx may be a factor, as abscess is not often seen in women or in children

Taking this with the fact that during general anesthesia the reflexes are abolished in whole or in part, foreign substances, especially blood, can readily gain entrance to the trachea and bronchi, and possibly to the alveoli. The pulling forward of the tongue by the anesthetist may be a contributing factor in operations in other fields. It must be borne in mind that the action of the cilia will probably also be inhibited

The same condition is present, to a great extent, in using local anesthetics when morphine is given by the operator before administration of the local anesthetic, and the cough reflex is abolished

While it is granted that there may be embolic abscess, the province of the laryngeal reflexes is to prevent aspiratory abscess, while one must admit that due to the aforementioned reasons substances may and do lodge in the pulmonary area, abscess does not occur unless these substances remain in contact with the tissues long enough to allow penetration

What other factors must be considered? To use modern slang, one might say, "When is an abscess?" In other words, what constitutes the first stage of the inflammatory reaction? Is there a true pneumonia, or do the bacteria which lodge on the mucosa later penetrate the deeper tissues, as suggested by Frederick in 1900, or is a massive atelectasis or a lobar atelectasis the first stage? I believe that it is possible for abscess to begin in several different ways, depending on whether the tissues are injured by mechanical or chemical means, or by chemical change in the tissues. Isabella Herb quoted Diesser as proving that ether may be concentrated as high as 34 per cent, while 7 per cent is as high as can be given without irritation

Kline and Berger said that while abscess and gangrene are separate entities, they are almost universally treated as one disease. Furthermore, they can be differentiated by careful examination of the sputum.

Another factor may be the splinting of the diaphragm in cases of abdominal operations, when the patient refuses to inspire deeply because of pain, or the lessening of the act of deglutition following tonsillectomy because of pain. The latter condition may also allow saliva to trickle into the larynx, especially in those cases of prolonged action of morphine or of the anesthetic

Whether infection takes place depends not only on the kind of infection, but also on the type of pathology as brought out by Joannides and by Kline and Berger

True abscess is caused by the pneumococcus or by the *viridans* or hemolytic type while gangrene was caused by the *fusospirochaetae*

That anaerobic bacteria were found by Pilot and Davis is proof that a plugged bronchus frequently occurs

Compression of the bronchus by a large peribronchial gland, as reported by me, may be a cause of lobular or even lobal collapse. This occurred in one of the bronchoscopic cases, the bronchus showed collapse, although other bronchi contained plugs. It required treatment with medical diathermy to clear the lungs completely.

The origin of the infection may be from a sinus infection. In six patients with massive collapse seen by me in the last year, five had infected sinuses, the sixth was not examined roentgenologically.

The putrid odor of the inspissated plugs from tonsils is most frequently due to spirochetal infection, this is true of the pus from pyorrheal pockets and from mouths in which the teeth are covered with deposits of calculus.

AURAL THERMOMETRY AS A DIAGNOSTIC AID IN OTOTOLOGY

PRELIMINARY REPORT

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It will not be amiss to review cursorily the pathology of inflammation in general and then to consider it as it obtains in the practice of otology

The four cardinal symptoms of inflammation known since the time of Galen are calor rubor dolor and tumor To these is added a fifth namely lost or altered function

Calor, or increased heat in the inflammatory zone is due to active hyperemia with its consequent increased metabolic rate This is a constant objective sign in all acute inflammations It may also be a subjective symptom for the patient may appreciate increased heat in the part but more often it is indistinguishable from the sensation of pain This can be ascertained in accessible regions by the examiner touching the part or by means of a thermometer held between the affected area and the examiner's finger and by the repetition of the process over normal tissue for the sake of comparison The general bodily temperature is apt to be raised if the inflammation is extensive or deep seated, but since this paper is concerned only with local thermometry I shall dismiss that phase of the subject for the time being

Dolor or pain is a subjective symptom that is inconstant, depending on the part affected It is the result of the inflammatory products causing pressure on the sensory nerve endings or by the bacterial toxins irritating the nerve endings

Rubor or redness is brought about by the increased circulation in the diseased area with its consequent stagnation

Tumor or increased size of the affected zone is caused by the distention of the site of inflammation by the increased blood supply, exudates and migratory cells attracted to the lesion by chemotaxis

Lost or modified function in the part is due to all or any of the causes enumerated and may be subjective and objective

It is on the presence of one or all of the signs cited that diagnoses are based It is indeed fortunate from a diagnostic standpoint, that all of these signs are coexistent and pronounced In the majority of cases one has to make a diagnosis on one or more of them

* Submitted for publication Aug 13, 1929

In acute processes of the ear, one likewise forms a decision as to the nature of the disease by observation of the local and constitutional symptoms

In a typical case, a patient presents himself complaining of pain in the ear with impairment of hearing. Here are two of the classic symptoms of inflammation, but one cannot yet arrive at a diagnosis. The condition may be due to an involvement of the external, middle or even the internal ear. By further questioning the patient as to the time of onset, location, intensity, etc., one gets nearer the truth but cannot yet rule out certain of the possible conditions. Physical examination by means of the visual and tactual senses is next resorted to. Edema, tenderness, or redness in or around the mastoid, auricle or canal are not found, but one does find the drum membrane red and bulging. So that by a complete examination one has elicited four of the cardinal signs, namely, rubor, dolor, tumor and altered function. These are sufficient for the purpose of making a diagnosis of otitis media purulenta acuta. Yet the one sign is lacking which would make this a truly typical case, namely, calor, and from the premises one knows that it is surely there.

It is true that in this particular case the diagnosis is fully established, and to ascertain the presence of increased temperature, by means presently to be described, is of academic significance only, but in cases that are not so clearly defined it may render valuable data as to both diagnosis and prognosis.

The method is based on the established principle that in all active inflammatory conditions there is of necessity a rise of temperature in the immediate zone of the active lesion and one could accurately measure it, provided the part is accessible and the instruments sensitive enough.

DESCRIPTION OF INSTRUMENT AND THE TECHNIC OF ITS APPLICATION

The thermometer used for this purpose is the rectal type with rather a large mercury chamber or, better still, the oral type that has been on the market for some time and advertised as "unbreakable," the bulb of which is a direct enlargement of the stem without being separated from it by a necklike constriction. These thermometers or the rectal ones have a circumference at the bulb of about 17 or 18 mm, French scale. These instruments are sufficient to take the anal temperature in the great majority of cases. For patients with wide canal walls I use an instrument with a bulb 19 or even 20, 22 or 24 mm in circumference, made up especially for me.

After the canal of the ear is cleaned of discharge or cerumen, the instrument (the mercury of which has been shaken down to 95 or below) is introduced as far as it will go into the meatus the bulb being

directed toward the drum, until its sides rest snugly against the sides of the canal. By exerting gentle pressure on the stem, sufficient to retain the instrument in the canal, an air-tight chamber is formed between the thermometer and the drum.

Great care must be exercised not to exert undue pressure on the instrument to obtain occlusion of the canal, one must depend rather on the proper relation of size between the instrument and the walls of the canal. Although it is desirable to approach the drum as closely as possible, on no account shall the instrument be made to rest on the drum by using too narrow a bulb. Nor shall one choose too large a bulb, for by so doing the test will be vitiated on account of the bulb being too far from the drum and hence too far from the site to be tested.

In a person with normal temperature and no lesion of the ear, if the instrument is used in the manner described it will be found that the aural temperature will register within 1 degree of the oral temperature. Any acute pathologic condition in the aural tract whereby heat is generated locally will by continuity of structure or by conduction be diffused to surrounding parts. In this method of thermometry the surrounding tissues directly and the air chamber will affect the mercury, and it will register a degree of temperature equaling or exceeding that of the oral temperature.

Thus, in a person with an oral temperature of 98 and with no acute condition of the ear, the aural temperature will register 97+. In diseases other than those of otitic origin the aural temperature will follow the oral temperature *pari passu* to within 1 degree. If a patient has a temperature by mouth of 100, he will show 99+ by ear, if the temperature is 105 orally, it will be 104+ aurally, etc.

In acute diseases of the ear with or without constitutional pyrexia, the temperature by ear will equal or exceed that registered by mouth. From the foregoing statements, one may deduce the following formula: Whenever the aural temperature equals or exceeds the oral temperature, irrespective of the normality or abnormality of the latter, one is dealing with an active pathologic process in the ear tract.

In using this method, one should not neglect to take the temperature binaurally so as to compare one ear with the other and both with that of the mouth.

It is practical in testing to watch the stem of the instrument and note the ascent of the mercury, for in so doing one can best judge whether the instrument is properly inserted. If the mercury does not show a rise after the position of the bulb has been slightly shifted and kept in place for a while, one may withdraw the instrument, for it has registered to capacity. It should also be remembered that it takes a

little longer for the instrument to register to capacity aurally than by mouth or rectum, and therefore it should be left in the ear about a minute longer than in the mouth or the rectum

ILLUSTRATIVE CASE REPORTS

CASE 1—I saw A. G., aged 2 years, on Nov. 27, 1928. The child cried a great deal the night before I was called, complaining of pain in the right ear. The rectal temperature was 102 F., the aural temperature was 100.2 F. in the left ear and 101.3 F. in the right. When the drums were examined, the left was normal and the right, red and bulging. Incision was followed by a sanguineous discharge. Next day there was a slight purulent discharge, from the right ear, though no pain or tenderness was present in or around the ear. The rectal temperature was 99 F. and the aural temperature 97.4 F. in the left ear and 97.6 F. in the right. The mother called me up the next day saying that the child had no fever and was doing quite well. Ten days later, the child developed a high fever. The mother stated that the discharge ceased completely three days ago, and that the child was doing well up to the previous night. On examination the left ear was normal and the right ear showed no pain, tenderness or edema in or about the ear, the canal was dry, the drum slightly pinkish and the incision closed. The rectal temperature was 104 F., the aural, 102.5 F. in the left ear and 102.5 F. in the right. Since thermometry in neither ear indicated any pathologic change, I told the mother to give the child a brisk cathartic and to notify me again the same evening. The temperature dropped to 101 F. the same afternoon and was normal the next morning and remained so.

In this case, the aural temperature relieved me of much anxiety concerning the child's aural condition.

CASE 2—E. K., a boy, aged 16 years, came to the office on Jan. 3, 1929. He complained of pain in the left ear of two days' duration. Examination revealed a normal right drum. The left showed redness over Shrapnell's membrane and adjacent parts, the rest of the drum was a dull gray and was distinctly bulging with loss of all landmarks. The oral temperature was 98.7 F. and the aural, in the right ear, 98.4 F. and 99 F. in the left. I advised myringotomy which the patient refused. On January 17, he came again to the office. Examination revealed no edema, discoloration or tenderness over the mastoid, but a profuse, thick, purulent discharge from the left ear. The right drum was normal. The left drum was soggy and had a large central perforation. The oral temperature was 99.2 F. and the aural, 98.6 F. in the right ear and 99 F. in the left. After five days, during which time he was instructed to irrigate the canal with copious quantities of boric acid solution, he presented himself again. The discharge had almost subsided, and the perforation in the drum was much smaller. The oral temperature was 99 F., the aural was 98.4 F. in the right ear and 98.4 F. in the left. He made an uneventful recovery.

CASE 3—A submucous resection was performed on Mrs. H. S., aged 32, on Jan. 10, 1928. Three days later she experienced pain in the right ear and later in the day noticed a discharge from the same ear. One week after the appearance of the symptoms, she came to my office. On examination, the left ear was normal while the right ear showed a purulent discharge and the drum was injected and slightly bulging. There was no pain, but tenderness was present over the mastoid. The oral temperature was 99.6 F., the aural, 99 F. in the left ear and 99.7 F. in the right. A diagnosis of acute mastoiditis was made and the patient referred

to the hospital for operation. A report from the hospital stated that there had been extensive bone destruction. The patient made a rapid recovery.

CASE 4—S. D., a man aged 23, presented himself complaining of pain and a discharge from the left ear of three days' duration. The drum was reddened posteriorly and showed a slight fulness and a small perforation in the anterior inferior quadrant. No edema, redness or tenderness was present over the mastoid. The oral temperature was 100.6 F., the aural, 99.5 F. in the right ear and 100.1 F. in the left, showing a local process subsiding in spite of what appeared at first sight as inadequate drainage. The patient made an uneventful recovery.

Incidentally, I might mention that aural thermometry may be resorted to in case a person is in a comatose state and other sites for thermometry are not conveniently accessible or in those rare cases of malingering in which the subject simulates fever by exerting friction on the thermometer bulb.

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Clinical Notes

DISKS IN THE ESOPHAGUS^{*}

SIMON FISHBERG, M.D., LOS ANGELES

Of all the foreign bodies occurring in the respiratory and upper digestive tracts, the commonest form is the disk. Of a total of 213 foreign bodies removed at the bronchoscopic clinic of the Eye and Ear Hospital of Los Angeles, 47, or 22 per cent, were disk-shaped. These were divided in the following order: 15 pennies, or 28 per cent; 12 nickels, or 27 per cent; 1 quarter, 1 half dollar, 6 metal slugs from electrical fuse boxes, or 15 per cent; 1 Chinese coin, 1 advertising token, 1 washer, 1 Mah Jong counter, 1 roofing disk, 1 lead disk, 5 buttons and a brass disk which was part of a toy whistle. With one exception, all of these disks were arrested in the esophagus, the exception, being only half a button and therefore not a complete disk, was removed from the respiratory tract.

The smallest disks were the pennies. It seemed rather surprising that there were no dimes, particularly as the dime is but slightly smaller than the penny, being 18 mm in diameter, while the penny is 19 mm in diameter. No available information is at hand to show in what numbers dimes have been swallowed. For some reason, they are not retained. There were two cases in which two coins had been swallowed: in one case the patient had swallowed two pennies, and in another, both a dime and a nickel, the dime being spontaneously extruded, while the nickel required peroral removal.

A disk may lie in the esophagus for a considerable period of time and cause but few symptoms. The early symptoms caused by entrance of the intruder are gagging and occasional coughing. As the esophagus becomes more tolerant, the symptoms largely subside, but there are usually gagging attempts from time to time. Swallowing is often but slightly disturbed although a large bolus usually does not pass. As the foreign body lies in the folds of the esophageal mucosa, inflammation and swelling gradually develop. Food and debris gather about the coin, and an esophageal infection is set up. There may be necrosis of the esophageal mucosa, and at this stage there may be symptoms of general sepsis. Fœtor ex oris is commonly present, owing to the decomposition of retained food and secretions.

It is noted from experience that disk-shaped foreign bodies almost invariably lodge in the esophagus. Disks lie flat on the surface of the tongue, and in any act that propels them backward they remain so, dropping into the upper part of the esophagus. Necessarily a disk must assume a position approximately parallel to the vocal cords before aspiration can occur, and the mechanism, assuming this sagittal position, is probably in most cases associated with the attempt to regurgitation. The disk, having passed into the upper part of the esophagus, is thrown upward and is tilted by the arytenoids into a position parallel with the cords. In the inspiratory effort which follows the vomiting act, the foreign body is aspirated. The alae of the thyroid cartilage may also aid in the tilting.

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^{*}Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929

A case described by von Schrotter¹ demonstrates the necessity of a disk assuming a position parallel with the cords if it is to be aspirated. In order to perform a so-called conjuring trick a man aged 35, stuck a coin into his left nostril. By bending the head backward he let it slide into his throat where he intercepted it by a slight cough, and brought it out by his mouth. He had done this often. On one occasion the coin had stuck in the esophagus for sixteen hours. This time it dropped into the windpipe.

Killian² mentioned the case of a patient, aged 29, who was desirous of performing the same trick in another way. He also had stuck coins into his nose. He put a second one into his mouth and by taking the former out of his nose, wished to produce the illusion that he had made it travel up from his mouth. During the proceedings the first coin began to move and slid into the trachea. Optimum conditions in position permitted the aspiration of these foreign bodies.

The site of arrest of a disk in the esophagus is almost invariably the same, viz the entrance of the esophagus into the upper thoracic aperture. This is just below the constriction caused by the cricopharyngeus.

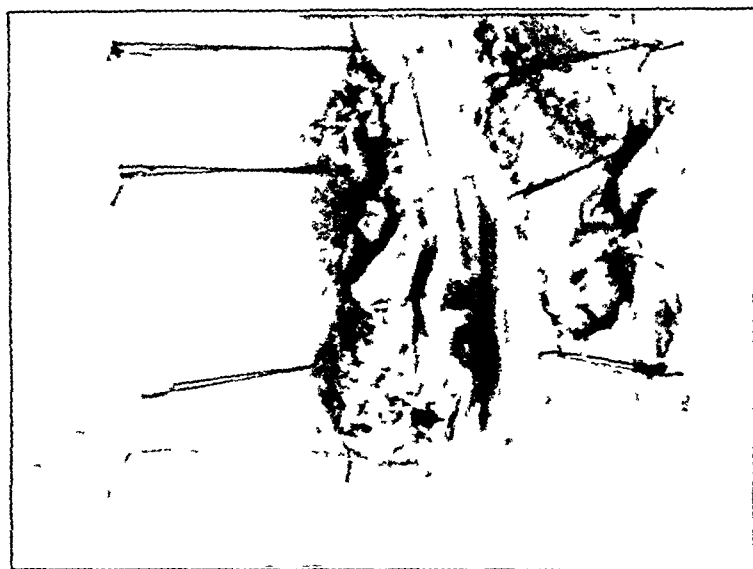


Fig 1—Anterior esophageal wall showing pouch which is bridged by a strip of normal tissue

One might suppose that the arrest would be at the upper pinchcock, but it is actually directly below. This is explained by the fact that during the act of swallowing the pinchcock is opened and the disk passing into the lower cervical esophagus is caught by the loose folds of collapsed esophagus. If the disk is not sufficiently large to fill the lumen of the esophagus so that downward propulsive effort is lacking when the pinchcock is again closed, it will stay there, being held by the loose folds of esophageal mucosa. The point of lodgment, as already mentioned is the superior thoracic aperture and the esophagus at this point is passively collapsed by the pressure of the surrounding soft tissues. The esophageal lumen at this point is wide as can be shown by endoscopic examination, and were it not for this collapse caused by the surrounding tissues, the foreign bodies would pass this point.

1 Von Schrotter H. Zur Bronchoskopie bei Fremdkörpern, Wien klin Wchnschr, 1907, no 25

2 Killian, J. A. Entfernung eines Pfenningstückes aus dem rechten Bronchus eines Erwachsenen vom Munde aus mittelst oberer Bronchoskopie, München med Wchnschr 1903 p 1601

An additional reason for disks sticking at this point is that the surface area of that part of the disk which is across the lumen in relation to that part of the disk in contact with the wall of the esophagus is much smaller than in the ordinary bolus of food.

It is of interest to note that the two largest disks encountered, namely, the half dollar and the advertising token, which was but a little smaller, were in the dorsal esophagus, well below the usual site. The half dollar also was not in the usual transverse position, being held in the oblique by the vertebral column.

Of all foreign bodies removed by peroral endoscopy, disks present the least problem. With a tube, usually an esophageal speculum, the disk is found, grasped and easily removed by traction. There is no difficulty in getting space for the forceps jaws, or in securing a firm grasp on the foreign body. The possibility of overriding the disk is easily avoided by anterior traction of the tip of the tube and careful inspection as the lumen opens. Slugs from switch boxes, six in this collection, have a sharp projection which is easily handled by using a rotation forceps on the opposite side of the disk from the projection.



Fig 2—Interior of trachea showing slit in posterior wall through which disk had eroded from esophageal pouch

In the forty-seven cases, there was one fatality. In September, 1927, a normal girl, aged 11 months, while playing with a part of a small tin whistle, choked and coughed. The mother, with an exploring finger felt the foreign body in the throat, but was only able to push the foreign body farther down. All symptoms subsided except an occasional gagging during and after eating. A pediatrician was consulted, who took an optimistic attitude toward the matter, this attitude being essentially, "Don't trouble trouble till trouble troubles you." The mother watched every stool for more than two months, with no results. Since there were no further developments and the child continued to be normal, the incident was more or less forgotten. In October, 1928, symptoms developed which were thought to be those of a cold. There were cough, fever and fetor ex oris. In about three months these symptoms subsided, and the child was apparently again normal. In March, 1929, some symptoms of respiratory irritation developed, and at this time a roentgenologic examination of the chest was made, with negative results. The presence of a foreign body was not demonstrated. One week before the patient's entrance to the clinic, she became unable to swallow. When swallowing was attempted, violent coughing ensued. It was reported that the child had not swallowed anything for a week.

Examination on admission showed a well nourished child suffering from marked dehydration and acrosis. A roentgenogram by Dr. R. G. Karschner showed a round opaque shadow in the middorsal region, apparently in the trachea although it was in the transverse plane. Tracheo-esophageal fistula was demonstrated with the opaque meal.

With the patient under local anesthesia a bronchoscope was passed into the trachea. A quantity of foul-smelling pus was aspirated and the disk was seen lying transversely across the trachea. Granulations were noted at the edge of the disk. A grasping forceps was applied and in attempting to rotate the disk to the sagittal plane it was folded on itself and so removed. It proved to be a thin brass disk 15.5 mm. in diameter and $2\frac{1}{100}$ mm. in thickness. It was perforated by two longitudinal holes.

A catheter was passed into the stomach and left in place for feeding. Energetic measures including intravenous injections of dextrose, hypodermoclysis, proctoclysis and tube feeding failed to save the child and she died about seventy-two hours after the removal of the foreign body. Air entering the digestive tract through the esophageal fistula despite the feeding tube was one of the most distressing conditions. A gastrostomy was considered but the child was never in a condition to endure the operation.

The results of the autopsy in brief were as follows. The heart and lungs were normal except for changes of a terminal stasis pneumonia. The abdominal viscera were macroscopically normal. In the anterior esophageal wall 3 cm. below the cricoid there was a pouch lined with epithelium. Over this was a bridge of intact tissue. At the right extremity of this pouch there was a vertical slit some 15 mm. in length which communicated with the trachea. The edges of this slit were covered with granulations which were continued into the trachea. On each lateral wall of the trachea at this level there was a line of granulations marking the site where the edge of the disk had rested. There was no evidence of suppuration of the lung except the terminal pneumonia as previously noted.

CONCLUSIONS

1. Disks are the commonest form of foreign bodies occurring in the respiratory and upper digestive tracts.
2. There is a clear anatomic explanation for the usual site of lodgment in the esophagus.
3. Disks rarely enter the respiratory tract.
4. The final disposition of a case of foreign body should be directed by those specializing in this work who would never cease in their search for the suspected foreign body until every available means, including endoscopic examination, had been exhausted.
5. Too much reliance cannot be placed on a single roentgen examination.

AN UNUSUAL FOREIGN BODY*

CHARLES J. IMPEPATOPI, M.D., NEW YORK

A Star safety razor blade was removed from a patient at Kings Park State Hospital. The patient was 36 years of age and had for some time been confined to the asylum for dementia praecox catatonic type. On March 13, 1929, in an attempt at suicide, after cutting himself in various places he swallowed the razor

* Submitted for publication, Nov. 18, 1929.

* Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929.

blade. Because of the wounds on the neck, abdomen and wrists, and as a cutting instrument was not found on the person of the patient a roentgenogram was taken, which showed a safety razor blade, with a cutting edge on only one side located in the upper portion of the thoracic esophagus. Late in the afternoon of that day, the patient was anesthetized, but when the esophagoscope was passed in the location that was predetermined roentgenologically, the blade was not found at this place, it had dropped to the lower portion of the esophagus, so that part of it was included in the cardiac end of the esophagus. A large Mosher esophagoscope was used, the blunt end of the razor blade was tilted so that the sharp right angle cutting edge was included in the end of the esophagoscope. The cutting edge was held at an angle of about 75 to 80 degrees away from the long axis of the esophagoscope, and the proximal end of the foreign body was included in the mouth of the tube with an alligator type of forceps. In this way the foreign body, forceps, and tube were removed together. In dislocating the foreign body from the grasp of



The Star safety razor blade, 40 by 20 mm, removed from esophagus of patient

the cardia, which was in a mild state of spasm, there was a slight amount of bleeding. Following the removal of the foreign body, the patient made an uneventful recovery.

About ten years ago, I reported a similar case in which a Gem safety razor blade was located in the cricopharyngeus, this patient also having attempted suicide. This was easily removed, without any bleeding. The Jackson, old type, esophageal speculum was used, the sharp edge of the blade was drawn into the open part of the speculum, and the foreign body, forceps and speculum were removed together.

A SPECIAL LIGHTCARRIER FOR THE SEIFFERT SELF-RETAINING DIRECT LARYNGOSCOPE WITH CHEST SUPPORT

JOSEPH W. MILLER, M.D., NEW YORK

Laryngologists working with the Seiffert apparatus know best how to appreciate this ingenious instrument. Not only has it entirely overthrown the famous suspension laryngoscope of Killian and its cumbersome and dreadful gallows, but it has made the operation of laryngoscopy a simple one which can be carried out in all cases under local anesthesia.

The one drawback was the source of light. This was supplied by using a Kirstein or a Von Eicken headlight, both of which throw parallel rays at a long distance and therefore are useful in direct laryngoscopic work. But the headlight

* Submitted for publication, Oct. 24, 1929.

* From the Department of Laryngology and Bronchoscopy, Beth Israel Hospital, New York City, Service of Dr. Samuel J. Kopetzky.

against the hypertrophied turbinate, causing discomfort to the patient and narrowing that passage, or, as is often the case, the turbinate is so large that it will not allow the septum to return to the midline.

It is a simple procedure, by means of a sharp elevator, to separate the mucous membrane and submucous tissues from the underlying bone and remove as much of the bone as is desired afterwards replacing the flap in position and holding it there for twenty-four hours by means of a petrolatum-soaked pledget of cotton. It will be found necessary to clip off a small portion of the flap before replacing it in position, as there will be a certain amount of redundant tissue. The incision is made along the inferior external border of the turbinate, and the dissection carried out internally, it is not necessary to separate it externally as this bone is always left. The hypertrophic turbinate is often found to contain a large cell which takes up the entire anterior portion of the turbinate and may at times contain pus, causing a congestion in that area. I have not found it necessary to employ stitches to hold the flap in place and there is little bleeding when the cocaine-epinephrine has worn off.

Little membrane is removed by this method, for which I do not claim priority, and the size of the desired nasal space may be obtained with exactness.

I have never been called on to reduce the inferior turbinate in this manner, but I do not see why this cannot be done just as easily when indicated.

News and Comment

AMERICAN BOARD OF OTOLARYNGOLOGY

An examination was held in Philadelphia, Oct. 21, 1929, during the session of the American Academy of Ophthalmology and Otolaryngology, held in Atlantic City.

One hundred and seventeen applicants passed the examination, five passed the preliminary examination, four were conditioned and thirteen failed.

In 1930, examinations will be held in Detroit, June 23, during the session of the American Medical Association, and in Chicago, October 27, the day prior to the meeting of the American Academy of Ophthalmology and Otolaryngology.

Prospective applicants for certificate should address the secretary, Dr. W. P. Wherry, 1500 Medical Arts Building, Omaha, for proper application blanks.

H. P. MOSHER, M.D., President

W. P. WHERRY, M.D., Secretary

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

LARYNGEAL TUBERCULOSIS

REVIEW OF LITERATURE FOR 1928-1929

GEORGE B. WOOD, M.D.
PHILADELPHIA

Primary laryngeal tuberculosis in children is so exceedingly rare that its rarity influences the examiner greatly when he is making a differential diagnosis of a suspected laryngeal lesion.

Richter¹ reported an interesting case of laryngeal tuberculosis occurring in a child, aged 15½ months. The disease ran an acute course, there being only four weeks of illness from the first symptom to the fatal ending. A careful postmortem examination showed an ulcerated condition of the larynx which, on histologic examination, proved to be tuberculous. The paratracheal and laryngeal lymph nodes showed early stages of tuberculosis and there was some tuberculous ulceration in the intestinal tract, with involvement of the regional lymph nodes. On the other hand, the lungs and the bronchial lymph nodes were absolutely free from any evidence of tuberculosis, as were also the liver and the spleen. Richter expressed his belief that this was a case of simultaneous and primary involvement of the larynx and intestinal tract due to infection from food. The tonsils were not examined, this was unfortunate, as it had been shown by animal experimentation that when food infected with tubercle bacilli was fed to hogs it produced tonsillar tuberculosis as frequently or more frequently than it did intestinal tuberculosis. It is possible that in this case some of the tonsillar tissue might have been infected and the larynx secondarily involved by an extension of the disease through continuity of structure. However, the laryngeal involvement was a primary one as far as the lungs were concerned. Its occurrence in a child aged 15½ months is almost unique.

Murray and Maxwell² reported a case which is of interest as a demonstration of the harm that may arise from a bloody operative attack on a tuberculous tonsil. The patient in this case was 22 years of age. There was a lesion on the left tonsil which, according to the authors, was suggestive of chancre. When this diagnosis was disproved, a tonsillectomy was done. The wound was slow in healing, requiring almost a month to do so, twenty-one days after it had healed, the beginning of an ulcerative process of the tongue was noticed. There

¹ Richter, Helmuth. Zur Klinik und pathologischen Anatomie der primären Kehlkopftuberculose, Arch f. Ohren-, Nasen- u. Kehlkopfh. **110** 225 (Nov.) 1928.

² Murray, W. H., and Maxwell, J. A. J. Laryng & Otol. **43** 335, 1928.

was an extension of the disease downward, involving the larynx. Latent tuberculous disease developed and the patient finally died of tuberculous meningitis. Autopsy showed old tuberculous lesions of both pulmonary apices. The authors said that they felt justified in operating on the tonsil because tuberculosis of the tonsil was extremely rare and they did not, therefore, suspect its presence. In this patient, however, not only was there tuberculosis of the tonsil, which should have been recognized and which is not extremely rare, but the patient was suffering from tuberculous disease of the lungs. Bloody operations on the tonsils of tuberculous patients are apt to be followed by a lighting up of any old tuberculous lesions that the patient may be suffering from. If a diagnosis of tuberculosis of the lung has been made it is our firm belief that tonsillectomy is absolutely prohibited.

An extensive and carefully undertaken piece of research work containing a review of all the literature on the subject, is that of Rickmann and Ernst³ on the value of the urochromogen and diazo reactions as well as of the blood count, the sedimentation test and allergy reactions in the prognosis of laryngeal tuberculosis. In their review of the literature they said that most authors are in accord concerning the value of the urochromogen and diazo reactions in the prognosis of pulmonary tuberculosis. In these cases both of these reactions when positive, indicate a certain amount of pathologic destruction of protein, the urochromogen test being the more sensitive. When these reactions are transitory they indicate a more serious condition though only when they are lasting and continuous is the prognosis absolutely unfavorable. They quoted Collet, who said that a positive diazo reaction in suspicious cases helps greatly in the differential diagnosis of tuberculosis, though a negative diazo reaction does not necessarily exclude tuberculosis. Rickmann and Ernst, however, in their researches in 100 cases of laryngeal tuberculosis did not agree with these observations of Collet. It was their belief that the urochromogen and diazo reactions have absolutely no value as far as diagnosis is concerned. They agreed, however, that a positive reaction indicates unfavorable prognosis and that as a rule the urochromogen reaction is more sensitive and appears earlier than the diazo reaction. From the therapeutic standpoint, however, a positive reaction is of value only in indicating that in such cases one should not undertake any extensive local treatment—such as the use of the cautery or the application of roentgen rays—and nothing more severe than general radiation with the Finzen light. Rickmann and Ernst found that the combination of the allergy test, the estimation of the sedimentation time of the red blood cells

3 Rickmann, L., and Ernst, F. Ueber den Wert der Urochromogen und Diazoreaktion, sowie den des Blutbildes, der Senkungsreaktion und der Allergieprüfung für die Beurteilung der Kehlkopftuberkulose, *Ztschr. f. Tuberk.* 50 465 1928

and a careful differential count of the white cells is of extreme value in the estimation of prognosis and in the determination of therapeutic measures to be employed. If these tests show a good resistance, surgical procedures and active therapeutic measures will get good results, but when the resistance is low, general treatment to raise this resistance should be undertaken before any radical local measures are carried out. An exception to this rule is when the pain on swallowing interferes with proper nourishment and hence there is the necessity of treating the lesions locally in order to allay the pain.

TREATMENT

A good deal of interest has apparently developed in Germany concerning the use of various gold salts in the treatment for pulmonary and laryngeal tuberculosis. Fischer⁴ treated about 115 patients with various gold preparations. He said that the beneficial action of gold therapy is not due to the action of the drug on the disease itself, that is, it is not a true chemical therapeutics, but by stimulating the reticulo-endothelial system it increases the general body resistance.

Schmidt⁵ obtained good results with a drug which has a gold content of 39.25 per cent. It is given intravenously, beginning with an initial dose of 0.025 Gm., the second dose is 0.05 Gm., the third, 0.075 Gm., and the fourth, 0.1 Gm. This rate of increase is continued for ten doses, when the final dose should be 2.5 Gm. At these doses the drug is well tolerated, and at least half the patients show no subjective symptoms of reaction. Almost all the patients showed general improvement though the drug did not so uniformly benefit the laryngeal lesions. Of six cases of laryngeal tuberculosis two showed distinct improvement and four cases no improvement.

Rickmann⁶ was not quite so enthusiastic about the use of gold preparations and said that they should not be employed to the exclusion of local measures. A good combination is the use of injections of gold preparations and local irradiation of the laryngeal lesions. Rickmann expressed his belief that it is a mistake to consider gold compounds a cure-all for tuberculosis, and that while a great many patients show distinct improvement, he is not certain but that equally good results might be obtained by other methods.

Schlapper⁷ used a colloidal gold salt containing 0.06 per cent of gold. He first investigated its dangerous possibilities on guinea-pigs. As

4 Fischer, A. *Ztschr. f. Tuberk.* **52** 465, 1929.

5 Schmidt, H. *Ein neues Goldpräparat zur Behandlung der Lungen und Kehlkopftuberkulose*, *Deutsche med. Wchnschr.* **54** 1757 (Oct. 19) 1928.

6 Rickmann, L. *Die Goldbehandlung der Lungen- und Kehlkopftuberkulose*, *Med. Klin.* **25** 103 (Jan. 18) 1929.

7 Schlapper. *Die Behandlung der Lungen- und Kehlkopftuberkulose mit Goldpräparaten*, *Tuberkulose* **9** 54 (March 10) 1929.

these animals stood the injections well and showed no evidence of anaphylaxis he used the drug in a large number of cases of pulmonary and laryngeal tuberculosis. In cases of laryngeal tuberculosis in which no local treatment was given, Schlappert said that the results were entirely satisfactory. The injections were made both intramuscularly and intravenously. The latter method probably causes less general disturbance, and neither method produced any evidence of kidney irritation. In 150 injections there was a slight transient shock in one case. The initial dose of the drug was 1 cc, which equaled about 0.6 mg of gold. In one case the dose was increased to 5 cc and the injections were given at first twice weekly and later once a week. One third of the cases became bacilli-free, in all there was a distinct lessening of the râles, and the roentgenograms showed shrinking of the diseased area.

Gainsborough and Jory⁸ used Jacobson's solution of benzyl cinnamic ester in a series of selected cases of laryngeal tuberculosis. These cases were either stationary or getting definitely worse. The treatment consisted of a series of intramuscular injections of 0.25 cc for twelve days, followed by rest for fifteen days. After three series of these treatments, the patient was given rest for one month before resuming the injections. Of seven patients treated, five showed distinct improvement, one little improvement and one started to improve but then became distinctly worse. The most striking feature was the disappearance of pain and dysphagia during the treatment. The authors expressed their belief that, if one considers the severity of these cases and the previous failure to improve, it must be believed that the benefit following the injections of Jacobson's solution was the result of the treatment. Positive sputum was obtained in all these cases until the end of the treatment. There were distinct roentgenographic evidences of the curative process going on in the lungs as the result of the three months' treatment in four of the six cases.

Apparently more interest is being manifested each year in the possibilities of roentgen therapy in the treatment for laryngeal tuberculosis. Unverzagt⁹ said that the benefit that comes from irradiation of the tuberculous larynx is due to the stimulation of the connective tissue elements that surround the tuberculous area. This stimulation causes the connective tissue gradually to circumscribe and obliterate the tubercle, leaving simply a connective tissue scar behind. For this reason, the dosage should be one that stimulates and does not destroy tissue. He said that the proper dose is essential, and that the method of cross-

⁸ Gainsborough, H., and Jory, P. J. Treatment of Tuberculosis by "Benzyl Cinnamic Ester," *Lancet* 1:1142, 1929.

⁹ Unverzagt, W. Die Kehlkopftuberkulose und ihre Behandlung, *Fortschr d. Therapie* 4:686, 1928.

firing the larynx first from in front and then from each side, is the method of choice

If a cicatrization of the tubercle can be produced by irradiation, one has a positive therapy for laryngeal tuberculosis. It would seem that the dosage necessary to produce the stimulation would be harmless, but it must be remembered that, for some reason irradiation of the larynx is at times accompanied with not only severe acute reactions but delayed phenomena which may in the end prove fatal. Badstober¹⁰ in his article on the dangers of roentgen therapy, particularly in laryngeal tuberculosis, reviewed a great part of the literature that has appeared in the last few years and showed conclusively that irradiation, especially that for laryngeal carcinoma, is not free from harm. In these cases, of course, the dosage of roentgen rays is much greater than that which would be required in the treatment for laryngeal tuberculosis. He said that the cases of damage from irradiation so far reported none have been cases in which treatment was given for laryngeal tuberculosis. He reported, however, three cases which came under his own observation. The first was that of a woman, aged 36 with a slight tuberculous involvement of the larynx. She was treated with a single large dose of roentgen rays which was followed by severe necrosis of the interior of the larynx and a fatal ending. Another case was that of a man, aged 35, who was treated twice with moderate doses. Closely following the second treatment, he became hoarse and developed odynphagia. The interior of the larynx was covered with a membrane which, however, gradually cleared up, though it was followed later by a deep, undermining ulceration of the laryngeal surface of the epiglottis. The third case was that of a man, aged 32, who, immediately after a surgical removal of the epiglottis and cauterization, was treated three times with moderate doses of roentgen rays. The larynx became so swollen that a tracheotomy was necessary, which, however, did not prevent a fatal ending.

During the past year, heliotherapy has apparently not received the enthusiastic acclaim that it did formerly. Sharp¹¹ said that in his hands the quartz light has not produced any change in the laryngeal lesion. In fact, Kayser-Peterson¹² reported the case of a girl aged 18 years, in whom the tuberculous infiltration was apparently stimulated by the treatment. He was not positive that the irradiation was the cause of the progress of the disease but at least it progressed in spite of the

10 Badstober, Paul. Die Frage der Röntgenschädigungen, insbesondere bei der Behandlung der Kehlkopftuberkulose, *Folia Otolaryng* **29**:175, 1928.

11 Sharp, B. H. Diagnosis and Treatment of Tuberculous Laryngitis, *Rhode Island M. J.* **12**: 56 (Jan.) 1929.

12 Kayser-Peterson. Treatment of Pulmonary Tuberculosis with Quartz Lamp Irradiation, *München med. Wchnschr.* **76**: 987, 1929, abstr., *J. A. M. A.* **93**: 811 (Sept. 7) 1929.

treatment. He thought it is advisable to omit radiation in this type of case.

Wessely¹³ said that in selected cases he has had good results with diathermy or electric coagulation and that as far as heliotherapy is concerned, some of his patients were benefited. He believed, however, that its use depends a good deal on the general condition of the patient.

Schugt¹⁴ said that in a fairly good percentage of cases, relief from pain in laryngeal tuberculosis can be obtained with actinotherapy with the ultraviolet rays. He uses the Kromayer quartz lamp, the light being projected into the larynx directly by means of the Atkinson laryngoscope. He has not obtained any marked results by the indirect method of reflecting the rays through a bent quartz tube.

It is apparent from the literature of the past year that the one method of treatment for laryngeal tuberculosis that is still being enthusiastically employed is the use of the electric cautery. Looper and Schneider¹⁵ have so well summarized their results and beliefs concerning the treatment of laryngeal tuberculosis that it seems worth while quoting some of their conclusions. In his discussion of their paper, John W. Carmack of Indianapolis said that the electric cautery has undoubtedly come to stay. I quote the following conclusions from the paper of Looper and Schneider:

The results of cautery treatments used sporadically in the Maryland Sanatorium until August, 1923, were so impressive and encouraging that we felt its continued and increasing use was our best form of treatment.

Of all our patients with laryngeal lesions with moderate lung involvement treated by electrocautery, 65.5 per cent were improved and healed, and 26.5 per cent with far advanced lung involvement were improved and healed.

In the Maryland Sanatorium we did not have any "unimproved" patients treated with cautery in the moderately advanced group.

Cautery treatment in many patients exercised a favorable influence on the lungs and on the general condition. No bad results were encountered.

Cauterization in all patients has been done under local anesthesia by the indirect method at monthly intervals.

Results obtained by electric cautery treatment indicate without doubt that tuberculosis of the larynx is curable, if started reasonably early.

In all suggestive cases we advise vocal rest or absolute silence. While active laryngeal tuberculosis does not have any tendency toward spontaneous healing, it is surprising with what rapidity some incipient cases with slight infiltration will clear up as the result of absolute silence. Therefore, regardless of whatever method of treatment is added, silence is imperative in all cases.

13 Wessely, E. Die Kehlkopftuberkulose, *Wien klin Wchnschr* **42** 176, 1929.

14 Schugt, Henry P. The Treatment of Dysphagia in Tuberculosis of the Upper Air Passages, *Arch Otolaryng* **8** 424 (Oct) 1928.

15 Looper, Edward A., and Schneider, Leo V. Laryngeal Tuberculosis. *J A M A* **91** 1012 (Oct 6) 1928.

The electric cautery seems likely to supersede all other procedures and enjoys at present increasing recognition as the best method of treatment for laryngeal tuberculosis

The revitalization of the tissues by induced hyperemia and the development of granulation tissue with formation of new blood vessels accounts for the good results obtained by the cautery

Elevation of temperature (high degrees), marked asthenia and high blood pressure are contraindications in using the cautery, although in patients in whom serious symptoms (severe pain, difficulties of swallowing) demanded alleviation, we did use the cautery to bring temporary relief

In using the electrocautery, one thing should be particularly and strongly emphasized and that is the condition of the lungs. No laryngologist should undertake electrocautery treatment without cooperating with or being guarded by a clinician. Indiscriminate use of the cautery in unsuitable cases will do more harm than good and the method of treatment itself will be brought into disrepute

Terry¹⁶ stated the belief that the use of the electric cautery will result in healing nearly all cases of tuberculous ulceration of the tongue if used early and that it is the best method of treatment for the tuberculous larynx when voice rest fails. He said that with early lesions complete healing is the rule after a few cauterizations, even in advanced cases it is the most efficient method for the relief of the excruciating pain, and some extensive lesions will heal after this treatment. Sharp¹¹ believed in its use in practically all cases in which there is not high fever and also as a palliative measure in hopeless cases

Schugt¹⁴ advised the resection of the superior laryngeal nerve when the pain of laryngeal tuberculosis is very severe, this cannot be done, however, in extremely sick patients. The injection of alcohol into the superior laryngeal nerve is less reliable and is not entirely free from danger, cases of necrosis of the larynx have been reported, and in one of these a mediastinal abscess developed. In one of his own patients, paralysis of the tongue followed the injection, owing to a simultaneous blocking of the hypoglossal nerve along with the superior laryngeal nerve. Edema of the larynx is not infrequent, and in one case of bilateral simultaneous injection Schugt was forced to do a tracheotomy. He uses the method originally suggested by Avelius Reti, that of making injections into the superior nerve in the pyriform sinus. According to Zuckermandl, the nerve can frequently be seen crossing the upper part of the pyriform sinus transversely, but Schugt himself was able to see it clearly in only two cases. The point of the injection should be in the fold of mucous membrane below the plica pharyngo-epiglottica where the shallower part of the sinus merges into the deeper portion. He generally makes the injection with a curved cannula by the indirect method. Only one side at a time should receive the injection on account of the edema which may follow this procedure

¹⁶ Terry, Geo. H. B. Cautery in Tuberculosis of the Tongue and Larynx, South M. J. 22 147 (Feb.) 1929

Abstracts from Current Literature

Ear

ACUTE MASTOIDITIS IN RELATION TO EPIDEMICS E. URBANTSCHITSCH, *Monatsschr f Ohrenh* **63** 882 (Aug-Sept) 1929

Urbantschitsch made a statistical study of the operations done at his clinic within the last fifteen years. Six hundred and thirty-seven mastoidotomies were done on 533 patients, on 104 patients, the operation was done on both sides. The discrepancies found between his own results on the incidence of mastoiditis in infectious diseases and Barwich's previous reports may be explained by the difference in their material, Urbantschitsch's clinic being at the main hospital in Vienna, to which all patients with infectious diseases are referred.

ANGIONEUROTIC DISTURBANCES OF ACOUSTIC NERVE K. GRAHE, *Ztschr f Laryng, Rhin* **19** 95 (Jan) 1930

Grahe presents a comprehensive review of the literature on angioneurotic disturbances of the acoustic nerve. In conclusion he states that he hopes his review has shown that angioneurotic disturbances are of great significance in otology, not only as a disease *sui generis* but frequently as one superimposed on other organic diseases the recognition and treatment of which, particularly with regard to the psyche of the patient, are of great importance. Accompanying the article is a bibliography containing 232 references.

PERMANENT INJURY OF ACOUSTIC NERVE CAUSED BY ROENTGEN STERILIZATION S. UNTERBERGER, *Ztschr f Laryng, Rhin* **19** 132 (Jan) 1930

Unterberger reports two cases of permanent injury of the acoustic nerve following roentgen sterilization. In the first case, that of a woman, aged 54, the injury involved both cochlear and vestibular nerves, in the second case, that of a woman, aged 50, it involved only the right cochlear and vestibular nerves. As proof of the fact that in both cases there was a causal relationship between the artificial exclusion of the ovarian functioning and the disturbance of the acoustic nerve, the author advances the following facts: 1. The disturbance of the acoustic nerve appeared immediately after the appearance of the artificially produced menopause. 2. It developed simultaneously with other characteristic disturbances of the menopause. 3. A thorough medical and neurologic examination did not reveal any other possible cause of the disturbance of the acoustic nerve.

MENIERE'S DISEASE WITHOUT INVOLVEMENT OF COCHLEAR NERVE REPORT OF CASE A. GIESE, *Ztschr f Laryng, Rhin* **19** 136 (Jan) 1930

Giese reports a case of typical Meniere's disease in a youth, aged 18, in whom the cochlear nerve was not involved. In a review of the literature he was unable to find a report of a similar case. In his case repeated apoplectiform attacks occurred in an ear that had previously been normal. The three cardinal symptoms of Meniere's disease (disturbances in equilibrium, nausea with vomiting and subjective auditory disturbances in the form of intense tinnitus aurium) were present. All tests were repeated several times and control tests were made. Particularly striking was the fact that neither during the attacks nor as a sequel of the disease was a decrease in the hearing demonstrable. The author believes that the subjective tinnitus aurium was not a symptom of an organic involvement of the cochlear nerve but was caused by a collateral condition. Although a considerable decrease in the hearing has hitherto been considered as a characteristic symptom of Meniere's disease, in the case reported by the author the

disease remained localized in the vestibular nerve, and the hearing remained unchanged in spite of numerous attacks

EFFECT OF STIMULATION OF VESTIBULAR NERVES IN SWIMMERS K. BECK,
Ztschr f Laryng, Rhin **19** 141 (Jan) 1930

Beck states that when some persons with a pathologically changed ear are under water, an excessive stimulation of the vestibular nerves results in a decrease or a complete loss of the sense of orientation, this may place the person in great danger and in particularly unfavorable cases may result in his death. The cases of sudden silent disappearance from sight of persons while swimming are not to be ascribed to the vestibular nerve. The author emphasizes the fact that in all cases of defects in the tympanic membrane and of cavities from radical operation measures should be taken to prevent the entrance of water into the ear.

Pharynx

TOPOGRAPHY AND MECHANISM OF THE TONSILS B. CHORONSHITZKY, Monatschr f Ohrenh **63** 1058 (Oct) 1929

On the basis of his personal studies and a review of the literature, Choronshtitzky comes to the following conclusions. The anlage of the tonsils is developed in the interarcual tonsillar fossa under increasing positive pressure, thus concentric layers of the peritonsillar connective tissue result, which form the basis of the capsule in the deep-seated tonsil. The pedicled tonsil, however, has no capsule. The last type of tonsil, therefore, cannot harbor a subcapsular abscess, and expulsion of its contents is far more easy than in the deep-seated tonsil. The double lobe of the tonsil is due to persistence of the embryonic intratonsillar fold, as von Hammar stated. The capsule caps the outer and upper surface of the tonsil, enclosing the fossa supratonsillar. The fringe of the tonsil lies between the mucous membranes of the side wall of the pharynx and the interarcual fossa. It is due to this cap that the enucleated tonsil appears on frontal section shaped like an arabic six (6). On its dorsal surface, the subcapsular abscess forms protuberances of varied size. Evacuation of chronic subcapsular abscesses are of far-reaching importance in various diseases of the tonsils. However, opening of a peritonsillar abscess with a stump hook by way of the lacuna is dangerous, and the result is doubtful. Recurrences after tonsillectomy are prevented only if the entire tonsillar fossa is enucleated.

Nose

CHANGES OF TEMPERATURE IN NOSE AS GUIDE IN DIAGNOSIS I. M. KRUKOWER,
Monatschr f Ohrenh **63** 838 (Aug-Sept) 1929

Krukower reports that the temperature in the nose as measured under the middle concha and under the inferior concha increases in both places in the same proportion in diseases of the accessory sinuses (maxillary sinus). In unilateral involvement of the maxillary sinus, the temperature is higher on the involved side than on the normal one. The severity of the inflammation is directly proportional, and its duration is inversely proportional, to the temperature. A chronic, long-drawn process shows only a moderate increase of temperature. Injection of 5 cc of milk (protein irritation) causes a focal reaction shown by a rise in temperature. On the basis of his experience in seventy patients, Krukower concludes that these measurements are a valuable aid in determining the diagnosis and the extent of the involvement.

OZENA RESULTS OF SURGICAL TREATMENT M. MEYER, Ztschr f Laryng, Rhin **19** 178 (Jan) 1930

Of five persons with ozena operated on according to Lautenschlager's method (displacement of the lateral wall of the nose) examination from three to five years later revealed that in only one, who irrigated his nose regularly, was the

subjective condition improved even in this patient, however, the objective condition was bad. In all of eleven patients operated on according to the author's method (implantation of several small pieces of tibia into the wall of the inferior meatus) and examined from two to four years later, the results were likewise unsatisfactory. The author therefore advises against operation in cases of ozena and recommends a return to the old forms of symptomatic treatment.

Miscellaneous

FOREIGN BODIES IN THE ESOPHAGUS AND RESPIRATORY TRACT B. HALMAGYI
Monatschr f Ohrenh **63** 847 (Aug-Sept) 1929

Halmagyi reports that during the period between 1922 and 1928 he extracted 112 foreign bodies with the help of the esophagoscope or tracheobronchoscope. The foreign body was located in the esophagus fifty-eight times, six times in the pyriform sinus, eight times in the larynx, nineteen times in the trachea and twenty-one times in the bronchi. Patients who had a foreign body in the esophagus reported at the clinic sooner than those with one in the respiratory tract, only four of these reported within twenty-four hours of the accident, the others, days and even months later. On the whole, foreign bodies are well localized, depending on the intelligence of the patient. Some have maintained that they suffered from dyspnea when neither the site nor the size of the relatively small foreign body could have caused a respiratory disorder, on the other hand, bronchial cases were noted in which the patients had difficulty only in swallowing. Halmagyi points out that the main cause of complications may be ascribed to the fact that a specialist is consulted only after weeks or months. To avoid these complications, immediate advice or treatment is necessary.

WEATHER AND DISEASES OF THE UPPER RESPIRATORY TRACT F. BLUMENFELD, Ztschr f Laryng, Rhin **19** 185 (Jan) 1930

Blumenfeld states that in statistics the effect of the weather on the morbidity and mortality of diseases of the respiratory tract may disappear completely. He emphasizes the fact that in researches on the relationship between the weather and the frequency of various infectious diseases it is extremely difficult to determine at what time the infection that caused the disease occurred.

however, showed that caries of the ossicles was not the most important factor, but that caries of the attic and antrum was. Histologic studies by Scheibe then showed that caries of the bone was not the only factor, but that the defects in the bone that were found were the result of rarefying osteitis resulting from previous acute infections. This was corroborated by Siebenmann and Spörleder.

This matter was a subject of debate for years. Manasse in his book on the pathologic anatomy of the ear wrote extensively on the question of disease of the bone in chronic suppuration, and differentiated between a productive and a destructive form, in the latter he found abscess formation, resorption of bone and sequestration. Other authors are quoted on the subject, e. g., Kaufmann and M. B. Schmidt defined caries as "every ulcerating process in bone the result of an interstitial intraosteal growth of granulation tissue, which takes on a chronic progressive course leading to a more or less definite loss of bone structure. A defect results at the carious spot." In conclusion, Mayer and Bever state that the question if chronic suppuration with bone destruction and without cholesteatoma may exist is not settled. Newer studies have shown that bone disease may exist in central perforation, but that it is due to acute infection of the old harmless otitis media, in such cases the disease is in the antrum and not in the attic, and therefore amenable to cure by the simple mastoid operation. The authors say that one cannot often be wrong in assuming that chronic suppuration with bone disease is due to cholesteatoma. Temporal caries in nonspecific otitis media does not fit the bone process found and should be termed rarefying osteitis.

There is a possibility of cure through purely conservative treatment. Scheibe over a period of eighteen years operated on only 3 per cent of his patients with cholesteatoma, and he never lost one case by intracranial complications. His good results were due to the following facts: 1. Most cases were private, and treatment was given personally with scrupulous care. 2. After the ear was dry each patient was inspected every two months. His treatment was irrigation of the attic and the antrum and the use of boric alcohol.

The general opinion is that cases of cholesteatoma cannot be permanently cleared up in this manner, because as long as the middle ear and antrum are lined with epidermis there is bound to be an accumulation of the masses. Some cases are more favorable than others, depending on anatomic conditions.

In marginal perforations of the posterior half, if conservative treatment quickly stops the odor and discharge and if the discharge is largely mucus, the ingrowth of epithelium has not reached the antrum and deeper epitympanic recesses, which are often shown to be lined with hyperplastic mucosa which will recede if good drainage is afforded. Such cases can be cleared up by conservative treatment.

Perforations in the membrana flaccida may quickly follow acute epitympanitis without many acute symptoms. The perforation may be so small as to be overlooked, and epidermis may grow in rapidly and develop largely in the antrum. Such patients after a symptomless interval may suddenly develop alarming symptoms of intracranial complication. Irrigations of the attic are not only difficult but dangerous. These cases are not amenable, as a rule, to conservative treatment.

Histologic studies have shown that caries of the ossicles is really either an acute rarefying osteitis following an acute otitis media or a chronic rarefying osteitis in the presence of cholesteatoma. In the first case recovery occurs without removal and in the second case removal does not destroy the underlying cause and is useless. Only in cases of marginal perforation of the posterior part of the membrana tensa is there a possibility of cure by ossiculectomy, and then provided cholesteatoma has not invaded the antrum. In perforation of Shrapnell's membrane it is of no avail.

All authors are agreed as to the dangers of intracranial complications in cases of acute exacerbation of chronic suppuration. The general consensus is that the radical operation should be done at once. The only exception to the foregoing rule as pointed out by Bever, would be when no cholesteatoma was found at

operation and the local examination showed no marginal perforation. In such cases the simple mastoid operation would suffice.

Heine pointed out certain indications for a radical operation in cases of acute suppurative otitis media:

1 When a previous simple mastoid operation has failed to stop the discharge and symptoms of retention are present such as headache and fever there is danger of invasion of the jugular bulb or labyrinth.

2 When the Gradenigo syndrome is present it calls for a thorough search of peritubal and perilymphine cells.

3 In scarlet fever otitis with extensive destruction of the drum and ossicles one should wait until the acute symptoms have subsided and the abscess or sequestrum has demarcated itself.

4 In intracranial complication a radical mastoid operation should be done at once especially in marginal perforation or cholesteatoma. A headache radiating forward from the ear or a feeling of numbness are significant as is an unexplained high temperature, so that one should not wait for further signs. In case of central perforation it is well to do a simple mastoid operation and await developments. Facial paralysis in cases of marginal perforation or cholesteatoma is an urgent indication for radical operation. Delay may mean sacrifice of probable nerve recovery. The only error may be in cases of central perforation when paresis is due to syphilis or to rheumatism.

Mayer and Beyer refer to the work of Zange and Ruttin in 1927 for indications in cases with labyrinthine symptoms. They also refer to reputed cases of intracranial complications in central perforation, and advise that if acute exacerbation occurs a simple mastoid operation should be done at once.

Many cases of exostosis of the canal are associated with congenital nerve deafness of various degrees, also such ears are sensitive to the shock of operative trauma which may further reduce the hearing. The danger of commotio labyrinthi from extravasation in the labyrinth was shown by Schwartze. Patients usually recover in a few weeks. Signs of secondary inflammation in the bone are the result of repeated irritation of the canal. Exostoses are of dense bone and difficult to remove, they have a tendency to recur unless they are thoroughly removed. Only isolated pedunculated ones can be knocked off. Otherwise the posterior canal wall must be removed as far as the bridge which is left intact.

In carcinoma of the middle ear, one is never able to expose all the growth which has usually passed beyond the tympanic cavity before symptoms appear. Operation is useless and radium is of no effect.

General opinion has not favored a radical operation (1) as a preliminary to removal of an acoustic tumor and to an operation on the labyrinth and (2) in basal fractures. Voss pointed out the dangers of secondary infection of the meninges from an existing otitis media infection introduced at the time of the accident and he urged operation. Lange was more conservative. In general the opinion is that unless there is impending meningitis not to operate. Meningitis was responsible for only 2.3 per cent of fatalities in a series of cases studied by Zange.

In children as a rule the operation is to be conservative. Only in the most urgent cases should a complete radical operation be done. It is better to do a simple mastoid operation and to wait until the child is older. The operative cavity in children is larger and more difficult to epidermize than in adults.

Absolute indications for a radical operation are (1) intracranial complications ensuing in the course of chronic suppuration with cholesteatoma (2) threatening symptoms, such as headache, dulness, vertigo, etc., appearing in a case with cholesteatoma, (3) an abscess occurring in the mastoid or in the canal in chronic suppuration or a fistulous breaking through in either location (4) as a preliminary to the labyrinth operation or in acute suppuration with abscess at the petrous tip (Gradenigo syndrome).

Relative indications are (1) chronic suppuration with marginal perforation of the posterior half, when careful conservative treatment has failed and especially when cholesteatoma and recurring granulations are demonstrated, (2) chronic suppuration with perforation of the membrana flaccida, persistent foul discharge and recurrent granulations despite frequent treatment, and (3) certain cases of exostoses, tumors and basal fractures

(Thus far, the abstract was written in collaboration with Dr Samuel Salinger)

The object of the radical operation is to convert into one cavity, open to inspection and treatment, the tympanic cavity, attic and antrum. The principal methods of approach are described: that of Stacke, via the external canal and attic, that of Zaufal, along the posterior canal wall, and the method based on the original Schwartze operation, via the planum mastoideum and the antrum.

For the skin incision, Zaufal originally used an L-shaped incision, one cut vertically behind the auricle, the other horizontally forward at the level of the zygoma, but later the single curvilinear incision at various distances behind the auricle became generally adopted (Heine, Koerner, Passow and Bezold). If a fistula is present the incision may be made through it, and if the soft parts are inflamed and swollen, requiring a larger incision, this may be made, or a horizontal one may join it if bony necrosis or changes in the dura require it. If it is necessary to continue the incision forward to get sufficient displacement of the fleshy canal, Koerner's suggestion to keep below the temporalis muscle is important.

Zaufal said nothing about separating the soft parts of the canal, but he made a tongue flap by two incisions posteriorly. Stacke elevated all the soft parts and pulled them outward, claiming that no ill effects ensued, as against Panse and others who thought that atresia of the canal and bony necrosis could be traced to careless handling of the soft canal. The opinion today is that bone splinters, remains of cholesteatoma or ossicles, or unremoved spurs on the attic wall are the causes, and that the fear of bony necrosis is unfounded.

Both Zaufal and Stacke used the gouge for the bone work, Zaufal also highly recommended the rongeur. Most of his early cases were fistulous, with large cholesteatomas and overhanging cortex, suitable for rongeur work. Stacke, on the other hand, had cases of sclerosed mastoids with small antrums, which he approached from the bony canal and attic, using his protector over the inner tympanic wall. In cases with large cholesteatomas he approached via the antrum, as Schwartze did, while Zaufal in sclerotic cases operated similarly to Stacke.

Jansen further enlarged the cavity by removal of the attic wall and the margo tympanici below, and showed that one need not fear accidental uncovering of the dura or sinus in trying to be thorough.

Stacke located the antrum by a probe inserted via the tympanic cavity. Zaufal chiseled along the posterior canal wall or just below the linea temporalis, but in cases of sclerosis advised the tympanic route for the probe. Recently Stacke's idea has been used more frequently (Beyer and Hinsberg). Beyer advises the Stacke method when (1) the sinus is far forward, (2) in sclerotic mastoids and (3) when the attic is narrow. The first two conditions are disclosed early in the chiseling, the third is discovered as soon as the soft parts are displaced. In poorly developed zygoma roots the bony canal is short and the attic shallow. If the roots are wide the upper canal wall and the attic gain room. A short, angled posterior wall and an oval canal also indicate a shallow attic.

A series of life sections are shown, which indicate. The tegmen antri, in both pneumatic and sclerotic mastoids, in relation to the dura of the middle fossa lies 5 mm higher than the upper canal wall. The antrum is mesial to and above the canal wall, so that the surest route to the antrum is via the upper canal wall. The posterior wall may lead to the facialis. In sclerotic mastoids the antrum is further behind the posterior wall and deeper in the mastoid so that the easiest approach is via the canal, and the nearer the membrana tympani the better. On the other hand the approach used by Zaufal gives a funnel-like opening for observing the antrum, and may reveal lesions of the posterior part, including fistulas communicating with extradural abscesses, which could

easily be overlooked in the approach by the Stacke method. One such case is reported. Mayer and Beyer advise the following choice of methods on the basis of experience and anatomic relations:

1 In fistulas of the cortex and abscesses of the mastoid with large cavities and in complicated cases, the method of Schwartz

2 In sclerotic cases and narrow canal, Zaufal's method via the upper posterior canal wall, widening the approach, then opening the antrum above and mesially to the upper canal wall. If the antrum is not easily found by this method one uses the small recurved gouge according to the method of Stacke and removes the attic wall, which discloses the antrum bulge posteriorly. One can then chisel above and parallel to the posterior canal wall with the assurance of being above the horizontal canal. The posterior wall must be removed sufficiently for the discovery of a possible cholesteatoma, perhaps beyond the sinus. The authors decry the use of the Stacke "protector."

It is highly important to be oriented as to the course of the facial nerve. This lies across the inner tympanic wall above the oval window, at the posterior edge of which (where it lies below the horizontal canal) it courses perpendicularly downward to the stylomastoid foramen. However, it may go diagonally outward under the posterior canal wall, or diagonally backward through the mastoid process, and so may be in dangerous proximity to the usual operative approaches. Mayer and Beyer quote principally Schwartz and Randall in studies of the course of the facial nerve. More recent and detailed works of other authors are not mentioned.

Uncovering of the dura has led in a few reported cases to complications. Mayer and Beyer express their belief that the danger is slight if proper precautions are taken in the after-care. On histologic analysis, (O. Mayer) dehiscences, hernias of the brain and vessel communications were at fault rather than the operative exposure. Most of the reported cases were acute suppurations. In some instances it is impossible to reach the antrum without uncovering the dura, but in any event this is far better than injuring the horizontal canal or the facial nerve. Uncovering the dura is indicated in cholesteatoma with headache because of the frequency of extradural or brain abscess in such cases. Also it is important to have a smooth upper wall, otherwise, cholesteatoma buds may be present in the depressions and lead to persistent discharge. There is no danger of adhesion to the facial spur if this is properly removed. The bony defect in the tegmen quickly regenerates. The authors say that in fifteen years they have seen no ill effects from uncovering the dura in the radical operation. As after care the plastic flap must not cover the dura, too long tamponade is to be avoided, and most important, in acute exacerbations posterior drainage wet dressings and careful control of the wound are essential. Injuries to the dura are, however, dangerous. Removal of the epitympanic wall is important until a smooth surface exists between the canal and the attic.

In cholesteatoma in the antrum and tympanum, Zaufal used thorough curettage plus thermocautery or trichloroacetic acid. Siebenmann used only careful irrigation and strove to protect the epidermis. At present a middle course is pursued. All pockets and depressions are carefully smoothed by chiseling, as in their depths there may be indications of deeper-lying conditions. Granulations and soft bone are curetted to healthy tissue, and epidermis is merely wiped or sponged away, leaving smooth epidermis in places. An exception is made of granulations in the canal region of a functioning labyrinth, as this may heal with preservation of function if the rest of the radical operation is done well (Heine, Scheibe, Uffenorde, Neumann, Ruttin and Zange). If the labyrinth is generally invaded by cholesteatoma or granulations the clinical picture will usually indicate its exenteration. If the labyrinth functions and there are granulations in areas between the canals, these may be curetted. Not seldom it happens that loss of function or positive liquor observations after a radical operation indicate labyrinthectomy.

Tubal closure and treatment of the tympanic cavity has been a subject of discussion since the radical operation has been done, as the tubal discharge was

considered the frequent cause of reinfection. Siebenman (1893) first called attention to this. He recommended as a preventive leaving open the posterior wound, avoidance of too thorough curettage of the tympanic cavity, preservation of tympanic membrane remnants and leaving the cholesteatoma matrix. He claimed excellent results. In 1907, the same procedure was recommended by his pupil, Nager, who stated that tubal suppuration was almost never seen in their clinic. On the other hand, Grunert (1896) emphasized the necessity of tubal closure for the epiderminization of the operative cavity. Jansen later called attention to curettage of the hypotympanic cells. Curettage of peritubal cells and actual cautery in the tube were practiced by Ferreri. Winker (1903) advocated removal of the anterior canal wall to obtain better access to the tubal region, but he said that tubal discharge was usually merely catarrhal and benign. Koerner called attention to obscure diseases of the adenoid and tubal region as a cause of discharge. Gerber tried skin grafts in the tube, Urbanschitsch used irrigation massage with rasp bougies and medication, but like other observers found lessened hearing after tubal closure. Lange (1910) showed that while tubal closure was desirable, the most careful removal of mucous membrane and curettage of tubal cells fails to bring about closure, as the tubal epithelium regenerates too fast to permit scar tissue to grow over it, he expressed his belief that healing of remnants of membrana tympani over the ostium, when possible, offers the best chance. Wittmaack (1910) recommended a pedicled skin graft from the wound margin, held into the tube by a catgut strand which had been brought out from within via the eustachian catheter. Later the same idea was tried by Pierce. Haberman and Gomperz tried trichloroacetic acid, and Yankauer devised a mushroom-shaped tubal curet. Passow used catgut nails to plug the tube. It developed later that the radical treatment in the tube was dangerous to the carotid, as was radical treatment in the tympanic cavity to the labyrinth. Scasz reported, in 1922, ten stubborn cases healed by roentgen rays.

The author believes that on the whole the best results are obtained by cutting down the bridge, removing the facial spur, carefully cleaning the bone splinters and grossly diseased tissue out of the cavity with a dull pincet, and wiping it out.

He thinks that the operation has not brought the expected progress in forty years, that it should not be named the "radical operation" in the sense that it insures definite healing, and that it still remains one of the most difficult of surgical procedures. He does think, however, that correct indications and appropriate technic are important in the outcome, and that the result of the operation is determined practically at the end of the bone work.

THE RADICAL OPERATION II THE PLASTIC OPERATION DR HERMAN BEYER

The younger otologists are unfamiliar with the development of the radical operation. They know vaguely the Stacke and Zaufal operations. For the plastic operation, with the history of which they are equally unfamiliar, they adopt one routine without understanding the underlying indications. As a rule the mastoid operation consists of the Schwartze entrance through the antrum, after which the posterior wall is removed and the attic wall is taken down. Schwartze's statement that in many cases the operation is only the beginning of the therapy and that in most cases the result depends on the after-care, is still largely true today. At first the easily stenosed canal was held open by tampons, later by a lead nail, and daily irrigations over a long period were essential. Fear of the cholesteatoma necessitated the posterior fistula. Kuester was the first to remove the posterior canal wall (which had been previously advised by Karl Wolf), but Stacke performed the first plastic operation. From this time on, numerous methods of treatment of the soft parts were devised.

Beyer illustrates innumerable varieties of plastic operations on the soft tissues of the canal, most of which are described in textbooks. The fundamental ones are those of Stacke, Panse, Jansen, Siebenmann, Koerner, Bruehl and Passow, the others being modifications of these. In general the best plastic operation is one devised for the case in hand. The flaps should not encroach on suspicious

bone, or on exposed sinus or dura, and should be so arranged as to give the best view and control of the cavity. The Barany technic of careful conservation of the soft parts and, after painstaking cleansing of the tympanic cavity, of replacing them uncut, or with only a temporary cut when absolutely necessary, has not been entirely successful in the hands of many other otologists. It was criticized by Bruehl, as more often requiring reoperation, and by Neumann, who said it is suitable only for a wide canal associated with a small mastoid exenteration. Beyer omits the plastic operation only in the presence of complications that necessitate leaving the posterior wound open, and in such cases does a secondary operation, as he also does in those cases in which the first plastic operation leaves too small an opening for proper observation of the cavity. The various methods are discussed in great detail. Neumann cuts a flap to lie upward or one to lie downward, according to which part of the cavity he wants to cover. If he has uncovered the middle fossa dura the flap is laid downward, in a low lying hypotympanum, the flap lies upward. Otherwise he uses either the Bruehl with a rectangular flap from the concha, or the triangular conchal flap, in either event with a horizontal cut in the posterior wall.

The object of the flap and the after-treatment is to preserve an epidermized cavity. The two general methods in use are the tampon, and the open method with drying powders, in either case one should control granulation tissue, and the tendency to form pockets or strands that interfere with drainage by tampon, chemical or actual cautery. Here again numerous technics are described in detail. Most operators use the packing until there is no danger of narrowing the cavity, i. e., until there is epidermization over the narrowest portion, between the facial ridge and the roof, then using the open method, with dusting powder or ointment. Urbantschitsch advised the use of 2 per cent salicylic alcohol after granulation stops. For destroying granulation tissue the preferred methods are the silver nitrate pearl or the actual cautery. Jansen preferred from 5 to 10 per cent silver nitrate solution at 2 day intervals in three successive applications, as too strong applications cause too much exudate and resulting maceration. Chronic and trichloroacetic acids have been reported as causing deep-seated symptoms, such as labyrinth irritation. Grunert and Heine recommend from 20 to 30 per cent lactic acid well rubbed in as safe and efficacious in controlling granulations. Alcohol was used by Heath. Others used drying powders, of which boric acid seems to be the favorite, although many proprietary drugs are mentioned.

For stimulation of the epidermis Bondy used picric acid in ether, 1:10, fanning the area to produce rapid evaporation of the ether, which is painful. Bruehl used zinc ointment for the protection of young epidermis, and Stein and Gaudier 5 per cent scarlet red ointment. Borries used 5 per cent hypertonic salt solution. Schmiegelow, in a critical review of this subject, said that the after-treatment had not changed fundamentally up to today, and he looked on the tamponless treatment as dangerous. A noteworthy observation was that epidermization takes place rapidly and well in cases of erysipelas. In regard to asepsis he said that usual surgical rules should govern. Incidentally, Beyer introduced a self-retaining dressing speculum that holds the flaps in place and expedites treatment.

The least infection of the wound may destroy the young epidermis and cause exuberant granulations. Granulations, especially in the round window region, are dangerous for the hearing. Labyrinth irritation calls for removal of packing and treatment by irrigation. The author believes it necessary for every student to understand first the tampon treatment, but also its contraindications and the usefulness of the other methods under the proper conditions.

The Thiersch graft was first used by Sibenmann, two weeks after operation, through the postauricular wound, after curettage of the granulations. Vulpius used the Reverdin grafts. Eschweiler, used Thiersch grafts immediately, closing the posterior wound. Politzer transplanted as soon as the plastic flaps were adherent, using a perforated glass bulb as a carrier of the new skin, which was applied against the underlying surface by a rubber bulb blower. Welty, after thorough removal of all bone to the vitrea and careful curettage of all mucosa,

on the fourth day transplanted one flap over the tube, one on the median tympanic wall, the spur and the mastoid cavity, and the third on the attic and the antrum. On the eighth to the tenth day he removed the piece over the promontory to conserve the hearing. With and Israel used a wax impression of the cavity to hold the grafts in place. Pontopiddian reported excellent results using petrolatum gauze to hold the grafts. Forselles opposed the use of skin grafts. Jansen was at first in favor of them and later opposed them as did Wood. Altogether these grafts are used less than formerly, but they still have their value in covering a large cavity or in preventing stenosis in a very small one.

The original method of postoperative treatment through the retro-auricular wound, which was more convenient and less painful, led in many cases to the undesirable postauricular fistula, the "hole behind the ear." For this condition numerous plastic operations were devised by many operators, these are described in detail in this well illustrated article. They depend chiefly on an incision behind the auricle, separate mobilization of the periosteum and the skin (after excision of the scar), and separate suturing of these tissues in two layers to cover the defect.

Cyst formation in the cavity is treated by puncture and packing or powder. Narrowing of the canal occurs mostly after trauma to the soft parts. For this the author recommends the Passow method of celluloid tubes laid in after the widening of the canal by removal of granulations or ingrowing epidermis under local anesthesia. Others use various plastic operations. Neither of these is successful in marked cases, which require reopening of the retro-auricular wound and the use of pedicled flaps from the surrounding skin, combined with the dilatation treatment in the canal itself until epidermization takes place.

Stacke claimed that healing occurred in 94 of his first 100 cases. Grunert reported healing in 74.2 per cent of 200 cases, with 1 death due to operation. Dench reported healing in 131 of 193 operations, with 6 deaths not attributed to the operation. Borries reported 1,108 operations, with 10 deaths, and computed the postoperative fatal complications at 1.26 per cent. Late complications were rare. Fabry reported 1, Neumann 2 and Lange 1.

Recidives are of three types: (1) skin inflammations due to accumulation of epidermal debris or to remnants of mucous membrane producing secretion, (2) superficial caries of bone, with or without the recurrence of cholesteatoma, which can occur even under healthy epidermis, and (3) malnutrition or tuberculosis, which requires general rather than local treatment. The principal offender appears to be the open tube, but relapses occur when the bone is poorly nourished, such as in sclerotic mastoids, particularly when associated with cholesteatoma, for this reason, prolonged control of the wounds is necessary.

Histologic examination by Neumann has shown that in spite of apparently perfect epidermization the bony changes of chronic inflammation are still present in the form of high grade osteoporosis, with fibrous tissue filling the marrow spaces, the residuals of osteomyelitis. Even the labyrinth compact is affected.

In the most important sense the operation is radical in that it protects against intracranial complications, but it is not always possible to achieve definite healing of the cavity, therefore the view of Bruehl and Neumann that a wide meatus is desirable to allow proper observation of such after-treatment as may be necessary from time to time.

The next question concerns preservation of function. In answer to this, numberless statistics are quoted which lead nowhere as the criteria are not standardized. In general it may be said that the hearing depends on its condition before operation, on the possibility of a conservative operation and on the status of the window regions as to whether thin membrane or thick scar covers them after healing. In general, the better the hearing before operation the greater its relative loss. The prognosis is especially bad if nerve deafness supervenes. Schoenemann expressed the belief that the hearing is better conserved if the anterior portion of the membrana tympani can be left, and Neumann advised avoiding trauma of the middle ear so far as possible. Opinions are divided as to the effect of closure of the tube. Neumann called attention to the value of even slight hearing for binaural function.

Beyer expressed his belief that the plastic operation is a necessary adjunct to the radical operation but acknowledged that the Barány modification has its place. He believes that with primary closure of the incision transplantation also becomes unnecessary except in a few cases. He also thinks that most operators will prefer the old method of tamponade as a routine but that more and more it will be used or omitted according to the experience of the operator. The end-results depend on the thoroughness of the operation, the resistance of the remaining tissues, the carefulness of the after-treatment and the healing proclivities of the patient. He quotes Neumann as saying "the antrotomy as radical the radical operation as conservative as possible."

Today, when one does not see many long-neglected cases, one has to a great extent lost the fear of cholesteatoma, but there still exists a little suspicion of the conservative radical operation which the author believes will also disappear as one learns of better results from it. The cosmetic results with primary closure are also better. The author gives great credit and thanks to the pioneers who forty years ago worked out not only the operation but the after-care so well that recent improvements are relatively few.

DISCUSSION

DR LANGE I was formerly opposed to the operation via the external canal but now am converted to this operation, which I do under local anesthesia. The operation is easier. There is less trauma and good oversight of the operative area may be obtained. I use mostly the Thies chisel, and occasionally the bone forceps of von Eicken. I excise by two parallel incisions a piece of the soft canal wall. I sacrifice this as it is unnecessary for the epidermization of the cavity. By operating in this way one begins in the diseased area and continues until healthy bone is reached.

DR LOEBELL Aside from intracranial complications the radical operation is done only in chronic epitympanic suppurations, mostly cholesteatoma, in which there is no diminution in discharge or odor after ten consecutive daily irrigations of the attic. The probability of the patient receiving the necessary local care is also considered. Operation is done via the mastoid. I believe that the operation is undertaken too readily by those who operate via the canal. I prefer local anesthesia. The ossicles are usually functionless in the operative cases and are therefore removed, except in cases in which there is closure between the epitympanum and the mesotympanum. The membrana tympani is preserved to cover the eustachian orifice. I use the Uffenorde plastic operation, the Uffenorde glass speculum and boric epinephrine salved tampons, usually with healing of the cavity in from four to six weeks.

DR THIES I prefer the external canal route except in complicated cases. Except for the removal of adhesions and polypoid tissue, the tympanic cavity and especially the stapes region is left untouched.

DR FREY Careful and regular treatment leads to anatomic healing in many cases heretofore though incurable. Operation is indicated in chronic suppuration with widespread cholesteatoma and with general symptoms. Cases with slight cholesteatoma are suitable for local treatment, and operation is performed only for repeated recurrences. Cases without cholesteatoma, even with marginal defect can be treated conservatively for many years. The danger to life in these is slight. Cases with slight or with no cholesteatoma are suitable for the conservative operation.

DR VOSS In acute cases in which suppuration occurs three or four weeks after antrotomy there is usually suppuration at the apex of the pyramid and a radical operation is required. For poor epidermization I recommend treatment with the Kromayer lamp. Drops of a brand of epinephrine, followed by a drying powder are used for tubal suppuration following the radical operation.

DR VON EICKEN The operation via the canal is done in cholesteatoma cases with sclerotic mastoid, as shown by roentgenograms. Local anesthesia is used

which occasionally causes a temporary facial paresis. I have given up the burr in favor of the Thies chisels. With the best of care, use of the burr in hard bone causes a caloric irritation of the labyrinth. The canal approach is safer and is the operation of choice.

DR HINSBERG. I agree with Dr von Licken. I use stereographs to determine the type of mastoid. I recall when meningitis (postoperative) was the great bugbear, now fortunately it is greatly lessened through better understanding and handling of the labyrinth cases.

DR OPIKOFER. Perichondritis, which is usually a *Pyocyanus* infection, is much rarer since better asepsis is obtained. However, if the suppuration is severe in cholesteatoma I prefer to defer the plastic operation two weeks.

DR NEUMANN. I do not favor the external canal route. Most cases of meningitis are monobacillar, if the infection is polybacillar it is suggestive of further complications. Acute exacerbations may be impossible of diagnosis, they may lead to suppression rather than to an increase of discharge. When this occurs with fever the observer must be on his guard. I avoid all superfluous manipulation of the tympanic cavity. It causes cysts and scars, delays healing and injures hearing. The operation via the canal is for selected cases only, and must always be looked on as experimental.

DR DAHMANN. It is an accidental matter whether the cavity becomes dry with the usual plastic operation. I have devised a spiral pedicled flap containing periosteum, which I lay in between the upper edge of the membrana tympani and the defect in the tegmen tympani, and with which I have had excellent results in appropriate cases.

RADICAL MASTOID OPERATIONS FOLLOWING THE METHOD OF BARANY, WITHOUT A PLASTIC OPERATION ON THE EXTERNAL CANAL. DR ENGVALL.

The results hoped for from this operation are (1) absence of the mastoid cavity, the canal being about the normal diameter, (2) in especially favorable cases, restitutio ad integrum, (3) less danger of perichondritis, and (4) simplification of the after-care.

From 1921 to 1927, ninety-five patients were operated on according to this method. A questionnaire brought in forty-one of these for after-examination. Of these forty-one cases, twenty had healed with normal or slightly retracted canals, ten had healed with the mastoid excavation restricted to the inner two thirds of the canal, eleven cases had not healed, and five of these had a cavity behind the canal wall which could not be observed through the meatus. Two cases required revision and a plastic operation, one because of recurrence of cholesteatoma with fistula in the horizontal canal, and the other because of recurrence of headache and continued suppuration of the wound.

REMARKABLE COMPLICATION OF RADICAL MASTOID OPERATION VIA THE EXTERNAL CANAL. DR KUEMMEL.

For some time the author has preferred the operation via the canal according to Thies, and until this case he has been successful. This patient sustained injuries to both ears from a grenade explosion in 1917, with concussion. He was treated as an ambulatory patient, but hearing was never restored completely. In 1918 he was treated by the author for otitis externa, complicated by a desquamative process in the epitympanum with intermittent discharge. He was seen again in 1926 and 1927, when headaches began. In 1928, headaches recurred, especially on the left side, and there was pain in the left ear, without discharge. On January, 1929, he was found to have perforation in Shrapnell's membrane, but it was suspected that his subjective complaints were largely neurotic, and no examination of the labyrinth was made. Operation was performed via the canal, and a plastic operation

was done Three days thereafter, fever developed, which was attributed to angina Three days later, the temperature was normal, but there was continued pain, on the fourth day, there was a temperature of 40 C (104 F), a murmur at the apex of the heart and an enlarged spleen The fever continued, and tenderness appeared in the parotid region, followed by swelling On the following day a posterior auricular incision was made which disclosed a cavity insufficiently opened, extending downward and backward, the flap was a granulating mass, the sinus, which was covered by normal bone, was explored by puncture and culture, with negative results Fever continued, with chills The parotid was incised, disclosing a deep-seated abscess, into which a drainage tube was placed The patient died eight days later, without evidence of intracranial involvement Autopsy disclosed suppurative thrombophlebitis exclusively in both cavernous sinuses, and beginning meningitis in the left middle fossa Both transverse sinuses were free Other observations were abscesses in the neck muscles, suppurative bronchitis, bronchopneumonia in the lower lobes, a septic tumor of the spleen and parenchymatous inflammations in the liver, kidneys and myocardium

The author believes that sepsis was due to operation, and he quotes Boenningham, Hartmann and Oertel on fatal complications from canal furuncle He believes that infection spread from the canal, via the lymphatics to the parotid, thence via the venae pterygoideus to the vena meningealis media The route via the temporal bone and bone veins has not yet been excluded by microscopic examination, but there was no macroscopic evidence of it It is possible that such an infection can ensue by infection of the plastic flap Although this is the author's first fatal case following operation via the canal, he thinks it safer to limit this operation to those cases in which there are serious objections to the only seemingly more elaborate approach from behind the ear

HEARING SENSATION UNITS AND HEARING AFTER THE RADICAL OPERATION AND AFTER ATTICO-ANTROTOMY DR C RUF

The author takes up the question of indications for and results of these two procedures in an article in which the reported cases are illustrated by graphs of the hearing and semidiagrammatic illustrations of the membrana tympani and the attic region in each case

The principal indications for the conservative operation (attico-antrotomy) is the hearing Hearing for the whisper of 15 to 2 meters, especially with positive results in the Gelle test, is considered an indication

The poor functional results after the radical operation are traceable to the persisting active changes, especially in the medial tympanic wall, as shown by Neumann, these do not occur to any extent when the tympanic cavity is protected, as in attico-antrotomy

The lower threshold for hearing after attico-antrotomy is lower than that after the radical operation, as a rule it is in the contra or subcontra octave In order to be exact in these measurements it is necessary to consider the intensity of the sounds at the beginning of the test of each tone Failure to observe this throws doubt on most of the published tests and claims

PATHOLOGY OF OLD RADICAL OPERATION CAVITIES DR H NEUMANN

On the basis of histologic studies, years after operation, the author is of the opinion that the labyrinth is not protected against injury even in what appear to be well healed cavities The degree of injury is dependent on the nature and the severity of the preceding inflammation, and the postoperative course through its effect on scar tissue is also an influence

Late complications of dangerous degree are rare, but Neumann reports three (1) a temporosphenoidal abscess, thirty-five years after operation, the cavity was covered by mucosa, which had suppurated especially in the region of the tegmen, (2) otogenic meningitis fifteen years after operation, via a granulating ulcerated

area in the tegmen, (3) meningitis nine years after operation, the tympanic cavity and antrum were filled with granulations

In both the radical and the conservative radical cavities, even when they appear healed, changes continue to develop. Among these is cholesteatoma, the specimen shown reveals communication between the cholesteatoma-containing niche and the lumen of the tube. The cavity is clothed mostly with squamous epithelium, overlying connective tissue of varying thickness. Where the epithelium is lacking the connective tissue shows an inflammatory reaction with pus formation. In the window niches numerous cysts lie within the connective tissue. The horizontal canal wall shows fresh bone catabolism, showing numerous giant cells under the subepithelial connective tissue.

The spongy bone surrounding the labyrinth compact shows marrow spaces fibrosed, filled with dilated, blood-filled vessels, or with granulations which represent defects in the epithelium. In one place, under normal epithelium covering the tegmen, the bony layer is very thin, in one place even defective. The bony boundaries of the marrow spaces show a lacunar contour, evidently the result of erosion. The second specimen shows much the same changes, also in places, under normal epithelium, residuals of osteomyelitic changes that seem to have subsided. The third specimen shows the condition four years after operation, the operative area had apparently healed in two months. The promontory shows a lacunar defect, filled with fibrous connective tissue and numerous dilated vessels, but no giant cells. No changes are shown in the labyrinth, which explain the facial paresis and vertigo at the time of the operation four years before. The atrophic membrana tympani covers the stapes, the cavity is epithelialized, but the underlying bone shows the previously described changes.

The clinical experience and these histologic studies show that while many operative cavities remain in the condition hoped for, many of them in the course of years do not, but develop conditions that easily make for a recurrence of bony inflammation. There are two ways of explaining the recurrence of suppuration. If the epidermis overlies thick connective tissue, bacteria from the never sterile cavity may penetrate, especially if pressure of cerumen masses or water macerates the surface. If epithelium lies directly on naked bone, nutrition is poor and slight injury suffices to produce infection.

These facts show that the cavity is more or less constantly undergoing metabolism and reactions even under intact epithelium. These processes on the labyrinth wall explain the loss of hearing and, to a less degree, the labyrinth symptoms.

POSTOPERATIVE BRAIN PROLAPSE F. FREMEL

The author recognizes two factors: (1) a bone-dura defect, and (2) outward pressure. The latter is caused almost exclusively by encephalitis or increased cerebrospinal fluid, mostly by the former. In the presence of encephalitis, dura that has been merely punctured may break down, thus permitting prolapse of the brain. Small abscesses and well encapsulated ones seldom cause prolapse. In fact, it is unusual to experience immediate prolapse in any case of abscess on first opening the dura. Prolapse occurs when something further is added to the original abscess, and this is usually encephalitis, less often it is pus retention or another abscess. The author is skeptical of the value of any of the usual mechanical measures for removal or reduction of the prolapse, except when the underlying cause can be removed or spontaneous recovery occurs. The author therefore uses for exploration a needle instead of a knife to obviate the danger of prolapse as far as possible, although even then it may occur. After it occurs he believes in expectant treatment only, i. e., the application of nonirritating sterile wet dressing and avoidance of adhesions to the surrounding tissues, awaiting subsidence of the encephalitis, which the author believes occurs as often without surgical removal of the prolapse as with it. Active measures are justified only when the underlying inflammation has subsided and the prolapse still remains. In the Neumann clinic, prolapse occurred in fourteen of thirty-nine cases of cerebral abscess, and in

only two of twenty-four cases of cerebellar abscess. This is explained by the greater mobility allowed the cerebellum tissues by the cisternae, which are shut off from the cerebrum by the tentorium. In the fatal cases prolapse occurred in 40 per cent of the fatal cases and in 28 per cent of the recoveries, so that prolapse is not necessarily of fatal prognostic import. There is some parallelism between prolapse and choked disk. In fourteen cases with prolapse there were five with choked disk, while in twenty-five cases of abscess of the brain without prolapse choked disk occurred in only three. Histologic examination of a section of prolapsed brain showed parallel dilated vessels, puckered together at the point of opening in the skull, the entire mass looked like a hemorrhagic infarct, with the tissues undifferentiated by beginning necrosis, and granulations inseparable from those of the radical operation. The inflammatory edema extended throughout the corona radiata.

Although the patient may become apparently well, persistent prolapse is always a locus minoris resistentiae, which easily becomes infected, resulting in encephalitis.

PHYSIOLOGY OF HEARING. EXPERIMENTAL INVESTIGATION OF THE MECHANICS OF THE OSSICLES AND THEIR RESPONSE TO TONE AND AIR IMPRESSIONS. DR. DAHMANN.

Fresh unhardened cadaver preparations were used. The middle ear was dissected out from the inner and upper sides, without disturbing the membrana tympani, ossicles or intrinsic muscles, or the attachments necessary to function, a bridge of the inner wall was left, together with the fenestra ovalis and the articulation of the stapes footplate. The dissection was done largely with dental drills, the debris removed by gentle irrigation and damage to essential tissues avoided. It is believed that the mechanical conditions were sufficiently near those in the living subject to avoid serious error. Air pressure was not more than ± 60 mm of mercury, and the tones used in the tests were within the normal stimuli as to strength and character. To register the amplitude and direction of the movements induced, a beam of light was thrown on the middle ear preparation, which was reflected by tiny mirrors fastened on the ossicles at the fulcrum and in the axes of movement. The preparation was then turned so that the reflected beams could be projected either on a screen or on sensitized paper on a kymograph. A series of preparations were made ranging from the isolated malleus-membrana tympani to the fully closed ossicular chain with its muscles and labyrinth attachment. A second series of experiments were made, beginning with the complete middle ear, and gradually removing one member after another.

Illustrations of the specimens are given, and their preparation described in detail. The article is further illustrated by reproductions of the projections on the sensitized paper resulting from the various ossicular movements, and by diagrams and mathematical calculations covering them. The factor of error is discussed, but these calculations are to be gone into more in detail in a later work. While there may be errors in the mounting of the mirrors, the pictures obtained are correct in relation to each other, and therefore permit conclusions being drawn.

The ossicles respond to both low and high tones, even to the very high whistle, with measurable movement. All the ossicles move in several planes, but one principal plane predominates, this is an in-and-out movement for the malleus and incus, which swing around a common axis. With a sufficiently strong impulse, side movements can also be determined. In addition, ossicular movement is influenced in certain directions by the intrinsic muscles of the ear. The same strength of impulse causes greater outward than inward rotation of the ossicles. This applies to both air pressure and tone vibrations. If the ossicular chain is intact, the impulse of both air pressure and tone vibrations diminishes in transmission from the malleus over the incus to the stapes. If the chain is disconnected from the labyrinth, both malleus and incus rotate to the same degree, even with rather strong impulses, marked movement of the membrana tympani transmitted to the malleus does not move the incus to the same degree.

So long as the vibrations are small enough (mild stimulation) to permit the stapes to follow the movement, and so long as the connections between the ossicles are firmer than the articulation of the stapes in the oval window, the chain swings as an intact mass. The lessening of the amplitude in transmission from the malleus to the stapes in the intact chain is not explained by the law of leverage, otherwise when the chain is disconnected from the labyrinth the malleus should show some diminution from the movement of the malleus. The lessening of the axial movement angle in transmission from the malleus to the stapes can be explained only by resistance in the tensed chain, which is equalized by the elastic connections of the ossicles.

In the transmission of more powerful impulses, the chain of ossicles does not act as a closed solid mass.

The graphs of various tone pictures show that the movement is wider for Ah, O and U than for the bright tones E and long A (German E). This is in keeping with the known necessity for an intact middle ear for perception of dull low tones. It is also shown that the plane of vibration changes with the character of the tone. Certain combinations of vowels AO, AE and OU, bring about the greatest excursions of the ossicles. This is in keeping with the experience with hearing tests and the carrying power of singing tones.

Changing intensity of sound causes no change in the plane of the excursions, but increases their amplitude only.

The functions of the tensor tympani are tension of the membrana tympani and the chain of ossicles, thereby decreasing amplitude and tone intensity, regulation of the plane of movement of the malleus, in the sense that it partially inhibits side movement, and a probable influence on the fundamental tone of the tympanic membrane itself.

The stapedius also tenses the ossicular chain, and in this sense is considered a synergist of the tensor tympani.

Proof of the fitness of the construction of the ossicles and their articulations for their function is shown in the registration of their movements.

The optical kymograph permits clear graphs to be made of both the pars tensa and the malleus during vocalization. Whether or not these satisfy the demands of scientific proof requires further investigation. They require investigation of the type and capacity of vibration of the membrane, of its fundamental tones, and of how far these tones are responsive with the proper periodicity.

The aforementioned calculations of the graphs and the vocal pictures furnish information as to the axial rotation of the ossicles, the amplitude of their movements, i. e., the chords of their arc of movement at the tip, which represents the length of excursion.

AMERICAN BRONCHOSCOPIC SOCIETY

Twelfth Annual Meeting, July 6, 1929

CHARLES J. IMPERATORI, M.D., *President, in the Chair*

CARDIOSPASM DR. CHARLES J. IMPERATORI

This article appears in full in this issue, p. 178

DISCUSSION

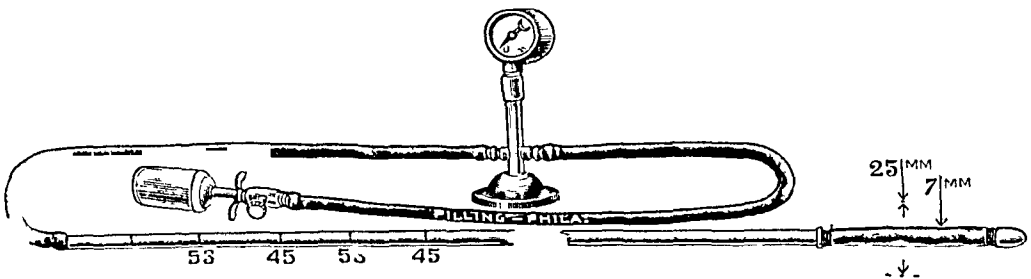
DR. GABRIEL TUCKER, Philadelphia. Dr. Imperatori has asked that we depart from the usual custom and discuss his presidential address. I feel that his masterly presentation of the subject commands the highest praise, and I have no discussion to offer. I have, however, an endoscopic hydrostatic dilator that I have demonstrated to Dr. Imperatori and wish to present under new instruments to the society as an addition to the instrumentarium for the treatment for so-called cardiospasm.

AN ENDOSCOPIC DILATOR FOR STRETCHING THE HIATAL ESOPHAGUS IN PREVENTRICULOSIS (SO-CALLED CARDIOSPASM) DR GABRIEL TUCKER, Philadelphia

The safest method of dilating the stenosed area in preventriculosis is the introduction, by sight, of the distally lighted beveled tip of the Jackson esophagoscope through this area. Direct inspection of the narrowing ulceration, infiltration or cicatricial stricture would contraindicate "stretching" as the term is used in the treatment for this condition. When the contraindication to dilatation is eliminated, the simple passage of the esophagoscope will give sufficient dilatation in a certain percentage of cases to effect a cure.

Blind methods of introduction of the dilator are often ineffectual even by the aid of a string and fluoroscopic guidance. Fatalities have been reported following these efforts. Recently, retrograde dilatation through a gastrostomy wound has been successful in a group of cases in which string-guided methods of introducing the dilator have been unsuccessful (Judd, E S, Vinson, P P, and Greenlee, D P. Retrograde Dilatation of the Esophagus for Cardiospasm, Surg Gynec Obst 48:494 [April] 1929). The idea of endoscopic dilatation is not new. Mosher's mechanical endoscopic dilator has been in use for many years (Jackson, Chevalier Peroral Endoscopy, St Louis, Laryngoscope Company, p 42).

The instrument consists of a dilating bag similar in construction to the Plummer bag, two rubber and one silk cylindric bags—an inner and an outer rubber bag



The endoscopic dilator for the treatment for so-called "cardiospasm." Air or water pressure, either as desired, may be used for dilatation.

with the silk bag between them. The distal ends of the bags are fastened to a rounded metal tip that is permanently attached to a slightly flexible metal rod that passes inside the inner rubber bag and is fastened to the distal end of a metal tube of 6 mm by a hub and spoke attachment. A groove on the circumference of this end of the tube also serves for the attachment of the proximal ends of the bags. This allows the dilating medium, air or water, to pass freely and quickly from the metal tube into the dilating bag, or vice versa.

The length of the metal tube is 65 cm, that of the dilating bag, 7 cm, the length over all is 73 cm, and is scaled for esophagoscopes of both 45 and 53 cm. A pressure manometer and release valve are attached to the air or water pressure supply tube for the control of pressure. The dilating apparatus, when deflated, will pass easily through a 9 mm full lumen tube.

The esophagoscope (9 × 53 mm full lumen) is passed through the hiatal esophagus into the stomach with the patient in the high-low (Jackson, Chevalier Peroral Endoscopy, St Louis, Laryngoscope Company, p 193) position. The use of the C L Jackson esophageal evacuator (Jackson and Coates The Nose, Throat and Ear and Their Diseases, p 1000) quickly and effectively empties the enormously dilated thoracic esophagus and avoids the difficulties usually encountered in esophagoscopy in these patients. After the esophagoscope has passed into the stomach, the dilator is introduced to the first "53" mark from the distal end, the esophagoscope is then withdrawn to the second "53" mark from the distal end, leaving the length of the dilating bag beyond the end of the tube within the hiatal esophagus. Pressure (from 10 to 15 pounds [4.5 to 6.9 Kg]) is then used under guidance of the manometer. The dilatation can be maintained as long as desired—

from three to five minutes (Imperator, C J Cardiospasm, Arch Otolaryng, to be published)

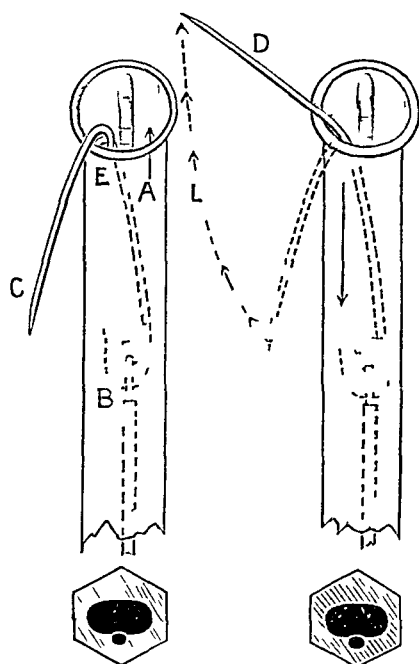
The thumb valve is then released, the bag is allowed to collapse and the dilator is withdrawn through or with the esophagoscope, as the operator desires. Repeated dilatations can be carried out as indications arise.

DISCUSSION

DR C J IMPERATOR: I feel that the Plummer Moshier method of dilatation for relief from cardiospasm is the one that will give results. The majority of our patients on whom dilatation was performed in the recumbent position did not respond the way those in the upright position did. Sustained dilatation from three to five minutes with a large sized Plummer bag, such as that shown on the screen and having an hourglass-like contraction, usually cured patients in from one to four dilatations. I think that the method of direct inspection and placement of the instrument suggested by Dr. Tucker is a good one.

A SAFETY-PIN ESOPHAGOSCOPE DR GABRIEL TUCKER Philadelphia

One of the sixteen endoscopic methods of removal of a safety-pin from the air and food passages as described by Jackson is the intragastric straightening of the pin (Jackson, Chevalier Bronchoscopy and Esophagoscopy, ed 2, p 251). In the cases in which this method is applicable, it is desirable to have tubes greater in



A safety-pin esophagoscope

the lateral than in the anteroposterior diameter so that the keeper of the pin will slip easily into it, and the tube should be small enough anteroposteriorly to avoid undue compression of the trachea. The tube is beveled on its shortest diameter and is of the Jackson type. It should be used with fluoroscopic guidance in the anteroposterior plane, so that the operator can be certain that the pin has been passed into the stomach before straightening is attempted.

AN UNUSUAL FOREIGN BODY DR CHARLES J IMPERATOR

This article appears in full in this issue, p 213

DISCUSSION

DR SIMON JESBERG I am interested in Dr Imperator's report on the razor blade. I had an insane patient who swallowed half of a Gillette safety razor blade, which lodged in the thoracic esophagus at the level of the aorta. An expanding esophagoscope was improvised by sawing lengthwise a heavy Lynah esophagoscope from the distal end to within 5 cm of the handle. The dividing portions of the tube then spread by themselves so as to increase the lateral measurement at the tip more than 100 per cent. A flat band attached to a wire held the two parts together. After the introduction of the tube the wire was drawn up, thereby permitting the tube to expand sufficiently to encompass the razor blade, and then the tube and blade were removed together without trauma in the esophagus.

I was impressed that the patient had caused no trauma in the act of swallowing the blade.

DEMONSTRATING BRONCHO-ESOPHAGOSCOPE DR CHARLES J IMPERATORI

This article will be published in full in the March issue of the ARCHIVES.

MASSIVE ATELECTASIS REPORT OF A CASE DR HARRY L BAUM, Denver

Dr Baum reported a case that seemed unusual to him. He was called by telephone from Albuquerque two weeks before presentation by a physician who stated that he had a patient with massive collapse of the lung on whom he wished Dr Baum to do a bronchoscopy. It was impossible for Dr Baum to go to Albuquerque, but the physician said that he was going to send the patient to him as the patient was ambulant. The diagnosis was immediately doubted. Dr Baum said that he had never seen a patient with that type of collapse who was not in a rather precarious condition. However, the patient came and when she was seen Dr Baum was much surprised to find by the excellent roentgenograms that she brought with her and also from the history of the case that there was no question but that she had had massive atelectasis for a month. She was apparently well physically; her pulse rate was about 100, there was a little shortness of breath on exertion, there was no fever, and she felt better generally than she had before the collapse occurred. The history was as follows:

Mrs Pulliam, aged 27, married, had had no children, although she had been married for three years and there was no pertinent history, either for herself or for her husband. She had an illness at the age of 10 which she said was severe bronchopneumonia on the right side. Since then she had had what was called "asthma," but which I think was an asthmatoïd condition, because she has never had asthmatic paroxysms, but simply wheezing at all times. She had also occasionally had pleurisy on the right side. She had gone to Albuquerque about six months previously on account of her health, having developed what was thought to be mild tuberculosis, as diagnosed by the roentgenologic and the physical observations, but not by the finding of tubercle bacilli in the sputum. She was thin and not strong, but was not acutely ill until this attack.

One month before she was seen, while in the mountains, she had suddenly, within twenty-four hours, developed the collapse. She had of course, suffered from embarrassed breathing and rapid pulse rate, up to 140. She was taken to Albuquerque and placed in bed for two weeks, during which time she was watched and studied by some excellent specialists for diseases of the chest, and a diagnosis of collapse was made from the physical and the roentgenologic observations. Her temperature at no time exceeded 99. She had slight cough with expectoration. The roentgenographic and physical observations were checked after her arrival in Denver, and there was no question as to the diagnosis of massive atelectasis of the right lung.

Illustrating the observations on the chest figure 1 shows the chest before the collapse. In studying this patient when she was first reported, her physicians fortunately took roentgenograms of the chest, which showed considerable evidence of tuberculous activity in the upper lobe of the right lung and some in the left.

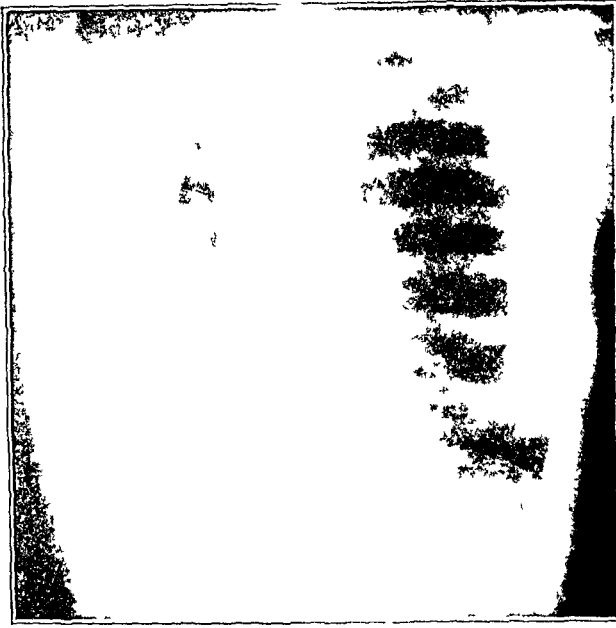


Fig 1—Roentgenogram taken six months before collapse of the lung occurred. There is evidence of slight tuberculous activity in both upper lobes, especially the right. Heavy fibrosis in the hilar regions and small areas of fibrosis throughout both lungs are visible.

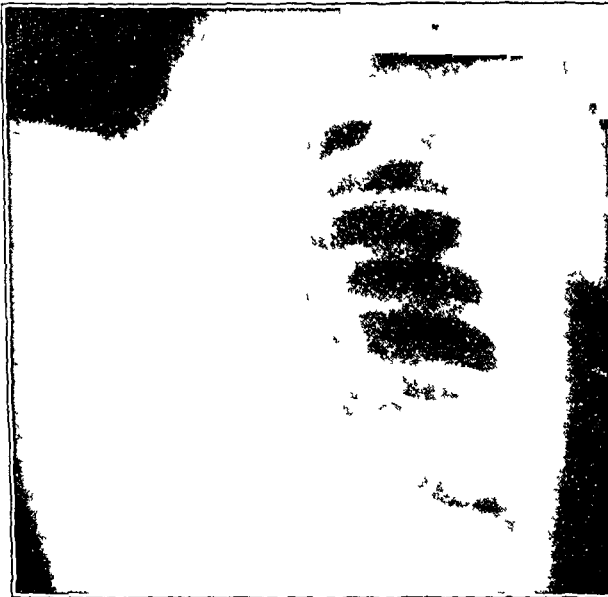


Fig 2—Roentgenogram taken immediately after collapse occurred. There is complete collapse of the right lung, the heart is moved over into the right side of the chest with overexpansion of the left lung.

lung There was heavy fibrosis in the hilar region and some areas of fibrosis throughout both lungs The bronchial condition could not be defined, the mediastinal shadow was somewhat thick to the right (fig 1) Figure 2 shows the condition after the collapse occurred and is the typical picture of complete atelectasis of the right lung, with the heart moved over into the right side of the chest and overexpansion of the left lung

Bronchoscopically, stenosis of the right main bronchus was observed, starting just below the carina The wall of the bronchus was covered with a whitish purulent exudate which scaled off easily The stricture was annular and was about 4 mm in diameter There was no pus exuding from the bronchus An aspiration tube could be passed through the stricture, and about 1 drachm of mucopurulent secretion of the same character as that coughed up was aspirated Roentgenograms taken after bronchoscopy showed no improvement in the condition of the chest The observations on the blood and the Wassermann reaction were negative, and the white and red counts were normal The purulent material aspirated was positive for tubercle bacilli, but not in large numbers There were no other important observations and nothing to indicate sepsis There was no history of foreign body

Dr Baum's impression was that this patient had a stenosis of the right main bronchus dating back to the time she had pneumonia at the age of 10, seventeen years before the collapse occurred, that her so-called asthma was due to stenosis and was really an asthmatic wheeze and that the collapse was probably due to a gradual accumulation of secretion plugging the stenotic bronchus and possibly the bronchi lower down

Bronchoscopy and aspiration apparently did not result in immediate benefit, but further observation was advised with attempts at dilatation and aspiration at definite intervals This is the first time that Dr Baum had seen massive collapse, the mechanism of which could not be explained and which did not show evidence of sepsis after having been present for a prolonged period The patient was ambulatory and had had the condition exactly one month when he saw her

DISCUSSION

DR THOMAS E CARMODY This case was interesting to me because Dr Baum spoke to me about it when he first had the telephone message, and we could not understand exactly how it could be massive collapse, but this was explained after he found that there was collapse of the bronchus

I had one case that I will speak of in my paper, in which there was massive atelectasis, partly due to plugs in the bronchi, where one bronchus was apparently compressed by an enlarged peribronchial gland There is a possibility that this might have occurred in Dr Baum's case, but did not show in the roentgenogram because of the entire exclusion of air In my case the condition followed pneumonia, and massive atelectasis occurred on the street after the patient had apparently recovered from pneumonia

SYMPOSIUM ON PULMONARY ABSCESS FOLLOWING TONSILLECTOMY

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY LARYNGOLOGICAL ASPECT
DR THOMAS E CARMODY

MEDICAL ASPECTS OF POST-TONSILLECTOMIC PULMONARY ABSCESS DR PHILIP
H PIERSON, San Francisco (by invitation)

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY BRONCHOSCOPIC CONSIDERATIONS AS AN AID TO THE SURGEON DR LEROY A SCHALL

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY BRONCHOSCOPIC CONSIDERATIONS DR LOUIS H CIFRÉ

THE POST-TONSILLECTOMIC PULMONARY ABSCESS FACTORS IN HEALING DR
EMILE HOJMAN, San Francisco (by invitation)

The papers by Drs Clerf and Carmody appear in full in this issue, pp 192 and 200, respectively, the other three will be published in the March issue

DISCUSSION OF PAPERS ON PULMONARY ABSCESS FOLLOWING TONSILLECTOMY

DR GEORGE L RICHARDS, Fall River, Mass I have been intensely interested in this symposium During a period of thirty-four years, I have had four cases of abscess in connection with tonsillectomy One was a case of virulent pleurisy in which no pathologic examination was made, the operation of rib resection was performed at a private house, with prompt recovery The purulent material smelled like an infection from colon bacillus, but it may have come from some embolus

One thing was brought out clearly by Dr Clerf, namely, that the statistics given out by the specialists on diseases of the ear, nose and throat at the hospitals may be misleading because we do not know the after-history of so many patients The patients may go to some other hospital, or they disappear The only case I have had that resulted fatally I did not know anything about until eight months after the operation The patient was a nurse in our own hospital She went back to work, was not very well and was seen by an internist, who made a diagnosis of bronchitis with possibly a little cardiac trouble She had that when she came to the hospital as a pupil nurse This occurred in my own hospital, under my own eyes, and I knew nothing about it Eventually, a diagnosis of abscess of the lung was made An attempt was made to find the abscess surgically, without avail The patient was sent to Dr Jackson's Clinic, and they had to do a number of bronchoscopies She came back to our hospital and improved somewhat, and after more bronchoscopic evacuation of the abscess the patient improved and went back to work, but in a few weeks she began to get worse, and at the end of about two years she died Whether the cause of failure was that the abscess was not discovered early enough, I do not know I think the point has been made by one or two that when the specialists for diseases of the nose or throat who are good bronchoscopists find an increase of temperature, even slight, following a tonsillar operation, the possibility of abscess of the lung should be considered The trouble is that as a rule the patients do so well that we get careless

The third case was in an adult, who was operated on by external surgical intervention, the abscess was discovered, and the patient recovered

The fourth case was that of a child in whom abscess was discovered fairly early I did the operation on the tonsils and did not know anything about the abscess until weeks afterward The first thing I knew the child was in the hospital for an operation for abscess of the lung by a general surgeon, who used local anesthesia The child recovered after a stormy convalescence

I have done thousands of tonsillectomies and these are four cases, over thirty-four years, in which I feel that I was probably the culpable agent

How can we get rid of these cases? There are many cases not reported, and I think that if anything should go out from both the triological and this society it is that an operation on the tonsils is far more serious than is generally conceded

As to the question of anesthesia, in the west these operations are done under local, in the east, we are more inclined to use a general anesthetic So far as I have noted, the mortality, either from abscess or from hemorrhage, seemed to be about the same, and Dr Clerf showed that more deaths occurred under a local than under a general anesthetic In the case I recorded, in the child, the only cause we could find was that the suction apparatus was not working well and some septic material might have been inhaled

So far as the etiology is concerned, I think that the aspiration theory takes precedence over embolism

DR EDWIN MCGINNIS, Chicago I had the good fortune to perform a bronchoscopy on a patient, a woman, about 35, whose bronchoscopic picture was interesting She had had a tonsillectomy done under general anesthesia I

reported this case in a paper before the American Laryngological Association three years ago. The notation as to the pathologic condition of the tonsils was that the crypts were full of necrotic material, some of which was squeezed out into the throat during the tonsillectomy. So far as the operation was concerned, the crux of the situation was that there was so much bleeding after the tonsillectomy that the patient was taken back to the operating room and the pillars of the tonsils were sutured to stop the hemorrhage. She developed untoward symptoms following tonsillectomy—a rise in temperature, some pain on the left side of the chest and a nonproductive cough.

I saw the patient about a month after the onset of the fever, and it was interesting to me that even though the patient had a good deal of cough which was nonproductive, there was no odor from the expired air. The roentgenogram showed involvement of the lower lobe of the left lung. When I passed the bronchoscope under local anesthesia, the right side was clear, there was no odor of untoward material in that bronchus. On the left side, the upper lobe was clear and there was no odor, but as I passed the tube down I came against a dark colored plug that completely occluded the lower lobe of the left bronchus. I used an ordinary Jackson aspirator, passed down the bronchus aspirated through the tube and as soon as the plug was removed I got some odor. The bronchoscopy was done in the morning, and late in the afternoon the patient began to have a productive cough. We kept up the bronchoscopy weekly for five or six weeks, and the patient made a fairly good recovery. But the physician who did the tonsillectomy was a general surgeon, who was desirous of using surgical intervention to help in the cure of this patient. He finally did a rib resection, and an interesting notation on the chart was that he did not find cavity formation in the lower lobe, but when pressure was made on the lower lobe with the finger the patient coughed and expectorated a plug of material. Following the rib resection, there was no drainage from the wound, and the patient made a good recovery.

DR BURT R. SHURLY, Detroit. This is a subject of great importance to the laryngologist. It interests everyone because we never know when our turn will come to meet some of these complications. For many years it has been a method with me to operate on all patients under general anesthesia on the side with the head somewhat lower than the feet. I have carried out this procedure for more than thirty years. To my knowledge I have never had a case of abscess, but just as one of the physicians said, these cases pass beyond the observation of the special hospital into other hospitals, and there does not seem to be the usual courtesy that one might expect—that the operator be called up and notified as to the complications that result. I think that that would be a fine courtesy if we would pass it around—to let the operator know what had really happened to his patient.

It would seem to me that the aspiration theory is the more reasonable, because the amount of septic material that is necessarily inspired under all the various difficulties of anesthesia is a frequent cause of this condition. In the old days of chloroform, the increase of pulse rate was much less, although the danger was increased. Operating for respiratory infection in the presence of a rise in temperature carries with it a great responsibility. It seems to me that if one third of all the operations in the hospitals of the United States are tonsillectomies, as has been reported by some observers, we have the most important subject in the world to consider at the present time. The operation is performed, not by experts as it was perhaps a decade ago, but it is now in the hands of everybody—pediatricians, general surgeons, general practitioners, those who have had a very short course in surgery and almost all the interns in the hospitals are now doing tonsillectomies—and I believe that the contraindications should be emphasized and safeguards thrown out much more extensively than they are. The operation in these cases in the presence of active tuberculosis does not seem to be sufficiently guarded. The administration of ether in the presence of acute pulmonary tuberculosis in its incipient stage is one of the things that should be avoided if possible.

The after-care of patients who have undergone operations on the tonsils, it seems to me, is not sufficiently understood or the dangers realized. We do so

many of these operations in which the patients get along well that in a majority of cases we do not realize the danger

I have always advocated conservative methods, and I think that the bronchoscopic method is conservative and a successful way of adding to the drainage. It seems to me that the external surgical route should be carried out only after other methods have failed.

Relative to the bronchoscopic considerations, I think that there is nothing to add to what Dr. Schall and Dr. Clerf have already said. There is a point, however, that has been striking to us in the treatment of these patients surgically, medically and bronchoscopically, and that is, when is the patient cured? The increased susceptibility to reinfection is important. We have observed a number of cases in which the roentgenologist and the internist, after examination, found that there was no further evidence of disease of the lung and the patient was discharged and sent home as well. In the course of two or three months, following an acute respiratory infection, he has returned with the symptoms of pulmonary abscess. If the patients who have apparently recovered from pulmonary abscess could be placed on a regimen similar to that in use in cases of tuberculosis of the lung, with rest and outdoor life for six months after the infection in the lung, there would be less danger of this reinfection.

In Dr. Jackson's bronchoscopic clinics in the Graduate and University Hospitals, Philadelphia, all patients with abscess of the lung under bronchoscopic treatment are given careful medical observation and care. Postural drainage, rest in bed, abundant diet, open air and sunshine are a part of the routine measures. The use of morphine and sedatives for cough that impair normal bronchial drainage is avoided.

DR. JOSEPH C. BECK, Chicago. I hesitate to take part in this discussion because I have never had a case of abscess, this is not said in a bragging way, but perhaps I have been fortunate.

I shall discuss the points that have been made about infection around the teeth and in the contents of the crypts of the tonsils, so far as *Spirochaeta dentium* is concerned. So often in tonsil cases patients have bad teeth also, which fact is not sufficiently taken into account. Many physicians in general practice advocate a tonsillectomy and pay no attention to the teeth. I wonder if the tonsils could not be treated preoperatively, not for weeks and months, but if the crypts contain not streptococci but cholesterol and a great deal of material that is found around the teeth, this could be removed before operation.

A few years ago Dr. Clendening of Kansas City condemned the use of the suction apparatus in connection with tonsillectomy, when he reported a case in which subsequently they removed a tooth from the lung that had lodged there owing to suction. After that, at a meeting in Philadelphia, Dr. Gvathmey made the statement that it was pure negligence for any one to attempt a tonsillectomy without a suction apparatus. I do not think that with general, or even with local, anesthesia with the patient in a recumbent position one can do an operation without the use of suction apparatus, and I believe that its use will prevent a great deal of this trouble.

DR. FRANCIS L. ROGERS, Long Beach, Calif. I have been greatly interested in the discussion of this subject, never having seen or known of a case of abscess of the lung developing in my own work in thirty-seven years' practice. I have wondered sometimes why, in a fairly busy practice, it has never occurred, and I feel that perhaps it is partly due to technic. It seems to me that a little care might be exercised in cases that appear to be unusually infectious. While in London last year, I saw a number of operations on the tonsils in the London University Hospital, with the patients in a different position from that which I think is generally used in this country. I thought that it might be interesting to some of you to know that they tilt the patients, after they are anesthetized, to an angle of almost 45 degrees and operate from behind, using an apparatus that is attached across the chest to hold the mouth open, and as they operate they look down into the mouth. As the drainage is from the lung, it seemed to me that this would

reduce to the minimum the possibility of infection getting into the lungs. The nose is more or less filled, but the field is clear and the opportunity to see the larynx in that position is excellent.

I noticed that Dr. Shurly spoke of another position which I have used a good many times, that is, the position with the patient on the side.

It seems to me that general anesthesia has a place in tonsillar surgery in adults when, and only when, local anesthesia is contraindicated. That is my practice, and I believe that if one is reasonably skilful in the application of local anesthesia it is preferable in adults. I have removed the tonsils from a boy of 8 under local anesthesia.

DR MARVIN F. JONES, New York. Owing to the criticism of the surgeons in regard to the work on the tonsils at the Manhattan Eye and Ear Hospital, they have organized a system of inspection which they hope will produce better results, so that I think in the future we shall be able to tell something more about abscess of the lung. I can recall the cases of only two or three patients operated on in the hospital who came back to us. We have had the experience that has been mentioned here—we never hear of these cases. With this new system of inspection, I think that we shall have reports that will be profitable.

I should like to ask Dr. Clerf whether, in these cases of abscess of the lung, he does not find many in which he cannot find the opening. Dr. Law is wonderfully dextrous, and can see the pus bubbling around but has not been able to find an opening, and he believes now that it is almost impossible to find an opening.

DR HENRY T. BAILEY, Phoenix, Ariz. I do not know that I can add anything to the discussion, but I should like to say that in my practice I have seen only one pulmonary abscess following an operation. That was in 1918, at the outbreak of the influenza epidemic. At that time we knew nothing about influenza—do not know much yet—and I hardly know whether this abscess came from the attack of influenza, or whether the influenza was coming on at the time we operated. At any rate, a large abscess in the lower lobe of the right lung was later operated on by a general surgeon.

I have traveled about the country a good deal and have watched different physicians do operations on the tonsils, and I have gained a few ideas. First examine the patient carefully before operating—tonsils, teeth, mouth and chest—and if the patient has any degree of fever, do not operate.

I learned from Dr. Joseph Beck years ago to hold up the soft palate. By running a catheter through the nose, bringing it out through the mouth, if the catheter is clamped, the soft palate can be pulled any way. It gives a full view of the pharyngeal fossae to watch the hemorrhage. Another thing, if I see bits of detritus squeeze out when I grasp the tonsil, I stop the operation long enough to remove them before proceeding.

If we were to obtain statistics of tonsillar abscesses throughout the country we might report more than really exist. This is exemplified in the case of a patient who came under my care two years ago—a woman who had been operated on in Nebraska. She developed pulmonary abscess, and not being satisfied with the treatment in Nebraska went to the Mayo Clinic, where they washed out the abscess once or twice. Then she went to the Jackson Clinic for treatment, after which she came to Arizona. On going over the history carefully and looking at Dr. Jackson's observations, I decided that bronchoscopic treatment was not indicated and that the abscess was clearing up. We depended on our Arizona sunshine, and after taking this sun treatment she is now well.

DR JOHN F. BARNHILL, Miami Beach, Fla. I have had just one case of abscess of the lung, so far as I know, in forty years. If I had that operation to perform again, I cannot conceive wherein I could make a change in technic. The patient was a woman teacher in one of the eastern universities, who came home on her summer vacation. She was given a thorough, not a routine, examination, her throat was prepared in the way of sterilization, and she rested in bed for several days. The operation was performed under local anesthesia procaine hydrochloride, without pain, and with considerably less bleeding than usual. About three days

later, she had several chills and a septic temperature and died within ten days. Post-mortem examination showed milary abscesses throughout the lung. I am convinced that circulatory abscesses, that is, a hematogenous infection, may occur in many of these cases, and do occur in some of them, though one works as carefully as I did in this case.

DR HARRY L. BAUM, Denver. It impresses me that two important factors are involved in the ordinary aspiratory type of pulmonary abscess or gangrene following tonsillectomy. One is aspiration of infected material, the other is the plugging of a bronchus and the collapse of a portion of the lung. Despite careful preparation, as well as careful operative technique, it has been shown by the studies of many men that aspiration of blood follows a large percentage of tonsillectomies under either local or general anesthesia, and I know of no method for preventing these abscesses except to check carefully after every tonsillectomy. I think that it is generally admitted that every tonsillectomy is potentially a case of abscess of the lung. If these patients are told to report back or are checked up by the social service worker, we shall be able to note cases early, and I believe that if we can see these patients early when the symptoms are beginning and subject them to bronchoscopy for the removal of plugs of infected material and blood, we can probably shorten the convalescence and possibly prevent the formation of abscess. We know that the ordinary foreign body which occludes a bronchus does not result in the formation of a typical abscess of this type, and we know that a foreign body of the dental type, especially a tooth, is likely to result in the formation of this type of abscess. The simple plugging of the lung is not sufficient for the development of gangrene. It is necessary to have in addition the presence of the spirochete and fusiform bacilli from the teeth and mouth which are seemingly essential to the development of this particular kind of pathology, which is really gangrene and not true abscess. So it seems to me that early aspiration, early removal of the plug, would facilitate drainage and aeration of the area and thus prevent the more serious sequelae of this type of complication.

DR W. F. VON ZEISEN, Fort Eustis, Va. I think that perhaps I have been more unfortunate in this respect than some of those who have spoken this morning. Late in 1925 and early in 1926, I had five cases of abscess of the lung. Four of the patients were operated on under general anesthesia and one under local. They all were given thorough physical examinations, the last one particularly because of the history. The patient, a woman, of somewhat slight build, was brought into the hospital four or five days before operation. Roentgenograms were taken of the chest, and everything possible was done, the operation was not particularly difficult, but seven or eight days afterward she manifested symptoms of abscess of the lung. It was remarkable that all of these patients recovered spontaneously. They were put to bed and treated as patients with acute conditions of the lungs, no surgical treatment being undertaken, the abscesses drained spontaneously after a certain length of time.

In trying to search for the reason, I found that my technique was no different than it had been in other cases. I remember having had but one case of abscess of the lung previous to that time in ten years, and that case followed the opening of a peritonsillar abscess. I concluded that there was some infection in the hospital at that time that had a predilection for that kind of case, so I resolved I would do no more tonsillectomies for a time. After eight weeks, I resumed operations with the same technique and in 40 or 50 cases I did not have a recurrence, nor have I had a recurrence since in probably 150 cases. The thought occurred to us that perhaps some respiratory infection was floating around, and we likened it to the complication of mastoiditis or pneumonia so frequent in measles. Some patients with measles will have pneumonia, some will have mastoiditis, some will have both and still others will have no complication. I have not heard the epidemic form mentioned, but I think that this particular series came close to being the epidemic form of abscess of the lung.

DR THOMAS E. CARMODY. Dr. Baum has suggested the possibility of unplugging the bronchus by aspirating early. Two of the cases I had were unplugged early.

They were simple cases of massive collapse one was not a complete collapse, but a collapse of two lobes I believe that we prevented pulmonary abscess in one case I think that is the thing that should be brought out, that if bronchoscopy is done in these cases early we will prevent abscess Bronchoscopy should be performed on any patient who develops symptoms following tonsillectomy, unless there is some contraindication

We have had four good papers in this symposium, and I enjoyed them very much The one of Dr Holman I enjoyed because I have read some of his articles, and while he leans toward the embolic theory and most of us lean toward the other theory, that is no sign that he is not correct Of the papers published—about fifty-five that I consulted—there were forty that leaned toward the aspiratory theory In the two cases I spoke of one patient was recovering from pneumonia ten days after an appendectomy, in the other, the atelectasis seemed to follow recovery from pneumonia

Dr Rogers speaks of his position We use a semi-Trendelenberg position, and think that we are preventing abscesses, although Dr Phelps suggested that the reason we had abscesses of the upper lobe was probably because the upper part of the lung is dependent

My statistics contradict those of Dr Clerf We had fewer cases in women and children, while in their series they had more women than men

I do not think that we should lean toward radical measures, whether surgical intervention or bronchoscopy We should not be too conservative, but we should be rational, trying to see all sides of our cases, and decide whether surgical intervention or bronchoscopy, or a combination of the two, should be used

Plugs from the tonsils are taken care of by the aspirator and thus are prevented from getting into the chest However, we may get plugs from sinuses that are not seen, but may be aspirated This was evidenced by five of six cases of massive atelectasis following infection of the sinuses A peculiar thing is that in the aspiration of these cases even if the plug is not seen, one can feel it hit the aspirator

Of course, it is understood that these patients had preoperative care In our cases, we always take care of the teeth have them extracted or cleaned up, and when we can we aspirate plugs from the tonsils, although we do not always get all the plugs even by that procedure A plugged bronchus gives the anaerobes a chance to grow behind the plug and they get out through the tissues Dr Baum made a suggestion the other day—the possibility of blood running down into the larynx even when the patient is conscious, and since blood does not irritate like saliva and other substances and is not coughed out a clot may form on the wall and bacterial action may begin in the tissues

DR LEROY A SCHALL Although this is a discussion of post-tonsillar abscesses, a number of abscesses do occur following other operations than those on the nose and throat I therefore wish to go on record as losing a case of abscess of the lung complicating a septic sinus thrombosis The abscess was shown by the roentgen examination thirty-six hours after ligation of the jugular vein

DR LOUIS H CLERF Dr Jones asked about finding the opening of the abscess when one does bronchoscopic aspiration I have never observed a case in which I was able to enter the abscess cavity with the bronchoscope, the abscess cavity may be entered in certain cases with the aid of straight or curved aspirating tubes

Regarding the question of early bronchoscopy in the treatment of patients with abscess of the lung, there are some who say that it is better to wait, that is, continue medical treatment and see whether or not the patient will get well Frankly, I do not understand the rationale of advising delay, especially after hearing today of the remarkable results secured from early bronchoscopy by others, and observing the results in many of our cases I believe that the earlier bronchoscopy is done the better

DR CHARLES J IMPERATORI Limiting my remarks to the treatment, I might outline what we do at the New York Post-Graduate Hospital when we have this

type of case We treat the patients by early bronchoscopy—the earlier in my opinion, the better for the patient The dictum should be aeration, and more aeration, and more aeration Frequently, bronchoscopy apparently results in nothing, that is, we see nothing, but the patient promptly gets well I have seen that in three or four cases within the past six months

Dr Yankauer has done a great deal of this work I was associated with him at Mount Sinai Hospital for a year and there I had the opportunity to observe this work as his associate and as an observer At that institution where early bronchoscopic work is done for abscess of the lung they irrigated the abscess or bronchiectasis Personally, I have never seen the rationale of irrigation of abscess of the lung I have never been able to get into the abscess I cannot conceive how the bronchoscope gets into the abscess One gets into the neighborhood of the bronchus that leads to the abscess and with a flexible aspirator is able to get some of the secretions from the abscess I believe that the cases that are discovered as abscess of the lung should be given at least six or eight weeks' trial by bronchoscopic and medical treatment The treatment I give is preliminary diagnostic bronchoscopy, postural drainage and the inhalation repeatedly, at four hour intervals, of oxygen Bacteriologically, mostly all abscesses of the lungs contain anaerobes I have never injected oxygen directly through the bronchoscope I use the ordinary gas-ether inhalation bag, using from two to four of these bags every four to six hours The patient is taught how to fill the bag and how to use the inhalation At the second bronchoscopy, if the patient has not decidedly improved and I can find where the pus is coming from, I usually instill an arsenical solution About 30 minims (190 cc) is sprayed into the bronchus, where we assume the abscess is located Usually the offensive odor of the sputum is diminished materially, and if one is going to get results from bronchoscopic treatment they are manifest within a short time I mean that one is able to say that one is going to get results from treatment by the cessation of the smell of the sputum, by the diminution of the amount of the sputum and by the general appearance of the patient A high caloric diet should always be given, but the thing I want to stress is that I do not wash out the abscess

SCIENTIFIC SESSION

THE PRESIDENT Before we begin our regular program we will hear a further report from Dr Harris P Mosher on cervical exostosis

CERVICAL EXOSTOSIS A FURTHER REPORT DR HARRIS P MOSHER, Boston

Through the courtesy of your Chairman I am allowed this opportunity to give a follow-up report on a case which to me is historical As far as I know, it is the first reported case of exostosis of the cervical vertebrae associated with difficulty in swallowing Since it was reported there have been other cases observed, and in my mind, at least, this form of pathology is established as one of the causes of difficulty in swallowing

Four years ago, a woman, then 78 years of age, came to me on account of difficulty in swallowing She was not examined by the esophagoscope, for reasons which I will not go into, mainly, the objections of her family, and she has not been examined by this procedure since The roentgen examination showed marked spurs of the sixth and seventh cervical vertebrae, and an old arthritic process higher in the cervical spine She had marked arthritic swelling of the joints, but at that time only moderate difficulty in swallowing I lost track of her after making a diagnosis, which the roentgen consultant concurred in, of difficulty in swallowing probably due to the sharp exostosis After the patient disappeared, she was seen by almost every well known physician in the country

She came back, after four years, a living skeleton on the edge of starvation I can say this—it was a great scientific satisfaction to me to have the case progress in this fashion The question was, what should I do Every swallow resulted in marked strangling, and my thought was to do a gastrostomy The roentgen examination showed that the spurs were of the same size as four years

previously. In addition, it showed the following new conditions. Barium given in the upright position resulted, as the taking of any liquid had resulted for a year or more, in marked strangling, so that the patient had given up going to the table. For some reason unknown to me, but through his keenness, it struck Dr. McMillin that if the patient were put on her back and given the usual barium sulphate meal something more might be learned, and to his great surprise she swallowed without strangling. The roentgen examination showed a much larger stream with the patient in the recumbent than in the upright position. I shall not go into the reason for this, if I know it, but she was relieved from much of her discomfort. She is now being fed, of course, in that position. If it does not work I see nothing else to do except a gastrostomy.

Shortly after that we performed an autopsy following a fatal case of carcinoma of the esophagus, and we found in that patient a marked exostosis of the lower thoracic vertebrae. The exostosis looked like a ring-pessary around the vertebral column. I was much interested in getting an extensive specimen. The exostosis, as seen at autopsy, was a round, smooth affair—very prominent, but round and smooth. In the patient of whom I speak the roentgen examination showed that the exostosis was sharp and needle-like and resulted in bleeding when the patient had a gastro-intestinal upset. I could not quite put the two together, but the roentgenogram of this apparently large, smooth exostosis showed the same sharp spurs. The soft material which makes the ringlike pessary—if you will allow me to continue that figure—is due to the enlargement of the anterior ligaments of the spine. I have a feeling that the patient probably has the same cushion over the cervical spurs, and I should now feel happier about trying to pass an esophageal tube than before I had this new pathologic knowledge.

THE QUESTION OF ANESTHESIA IN PERORAL ENDOSCOPY DR. EDWIN MCGINNIS, Chicago

Twenty years previously, the men with whom the author worked used ether anesthesia in endoscopy combined with the administration of atropine sulphate to check secretions. They experimented later with chloroform, but its use was followed by two fatalities.

Eventually, Dr. Ingals used local anesthesia in a man, aged 45, to remove a gold band crown from the upper lobe of the right bronchus which had been in situ for nine months. Although considerable traction was necessary to remove the foreign body, the patient felt no pain. Following this experiment, he used local anesthesia in adults, but with children only morphine and atropine.

Four years previously, after experiencing difficulty with interns and trained assistants, and losing two cases, the author again adopted the use of general anesthesia, the trouble with secretions being obviated by use of suction.

He cited two cases illustrating the greater ease with which he could remove foreign bodies with the patient relaxed by general anesthesia, one, a man, with a five-tooth gold bridge in the left bronchus, the other, a woman, with a piece of chicken bone in the esophagus, where emphysema was elicited in the neck previous to endoscopy.

He summed up the disadvantages of ether anesthesia as follows: 1. Excess secretion, overcome by mechanical suction. 2. In cases of small particles, such as nuts, the patient cannot be made to cough. 3. Some cyanosis when one main bronchus is partially or completely occluded by foreign body.

The advantages of complete anesthesia were: 1. Work can be done without trained assistants. 2. Complete relaxation and in bronchoscopic cases relaxation of the bronchi. 3. In children, absence of fear and shock.

DISCUSSION

DR. HARRIS P. MOSHER, Boston. In regard to the relaxation of the esophagus obtained by ether, I am very much impressed by it in connection with sharp foreign bodies in the esophagus. You do, however, get relaxation, and I am surprised how readily it occurs in bronchoscopy done as a routine measure with cocaine.

DR SIMON JLSBERG, Los Angeles I cannot help but feel that the choice of anesthetic in endoscopic cases is of great importance. We must necessarily be governed in our choice by the age and condition of the patient. In esophageal foreign bodies, local anesthesia, with the struggling of the patient, is dangerous, and I feel that the general anesthetic is the choice in that case. However, in respiratory foreign bodies I use local anesthesia. I think that we do not use enough morphine, particularly in children. In talking it over with a prominent pediatrician, I brought up the point that we were taught that morphine is not for the young or the old, but I think that we were taught incorrectly. I recall distinctly a child 18 months of age with a bean in the bronchus, who had a collapse of the lung, and something had to be done quickly. I knew that the child had low vitality and would not stand an anesthetic, so I administered morphine $\frac{1}{20}$ grain (0.0032 Gm). I had to work one hour to remove the bean piecemeal as there were no spaces for forceps. We had a very close call, and I do not believe that the child would have come through without morphine. I use morphine in physiologic doses, i. e. sufficient to cause the patient to relax completely, regardless of age or the local anesthetic. I use very little cocaine, but I have used butyn since it came out and have had but one diagnostic reaction. I use sufficient to get good analgesia.

DR LOUIS H. CLERF, Philadelphia I am interested in the use of morphine because that is our mainstay in the Clinic in Philadelphia. We use morphine in large doses, not only for adults but for children. I have made it a rule to accept as the adult dose $\frac{1}{2}$ grain (0.0324 Gm) of morphine sulphate for a normal person weighing about 160 pounds (72.6 Kg), and then to compute the dose for children on that basis. It may seem a rather large dose, but so far no ill results have been seen. We do not prescribe atropine with morphine in cases of foreign body because we believe that atropine will tend to dry up the secretions, and often there is enough difficulty without that. In adults, I like scopolamine combined with morphine, given an hour and a quarter or an hour and a half before the esophagoscopy or bronchoscopy is performed. This will give satisfactory relaxation.

DR EUGENE R. LEWIS, Los Angeles It happens that Dr. Baum and I were discussing the use of morphine in the case of children last night. I told him of a $2\frac{1}{2}$ year old child sent to me by one of our pediatricians with instructions that on account of some thymus condition neither nitrous oxide, ether, chloroform or ethylene could be used. The youngster had been ill for three or four days with what was diagnosed as diphtheria, but it was apparent that it was a case of foreign body. The foreign body turned out to be a large wild oat $1\frac{3}{4}$ inches long, completely embedded in the left tonsil. In that case, we gave the child $\frac{1}{4}$ grain (0.0162 Gm) of morphine with $\frac{1}{150}$ grain (0.00043 Gm) of hyoscine at one dose, and repeated it in about forty-five minutes, and while there was not complete narcosis the youngster was sufficiently relaxed to permit of easy removal of the foreign body.

An obstetrician in the family was there at the time and seeing the effect of this narcosis he said, "I wonder if we could not use that safely for the performance of a circumcision, which has been deferred on account of the question of anesthetic." About a week later, I anesthetized the baby again, $\frac{1}{4}$ grain of morphine and $\frac{1}{150}$ grain of hyoscine being used, and the surgeon circumcized the child with ease. I am sure that Young's rule, while it may have been true in the last century, does not fit this.

I give children between 18 months and 3 years $\frac{1}{4}$ grain of morphine at one dose and have had no difficulty.

DR LYMAN RICHARDS, Boston Like Dr. McGinnis, I shift about from ether to local anesthesia, and I have come to formulate no hard and fast rules. Occasionally, with a patient under a local anesthetic, I have failed at the first attempt to remove the foreign body, but have succeeded with the patient under ether. On the other hand, I have failed occasionally in instances in which ether was used, and in some cases in which there was cessation of breathing and alarming cyanosis, I have allowed the patient to come out from under the anesthetic and resumed

without any My feeling is that in practically all children any bronchoscopic work should be done without a general anesthetic

I am in favor of larger doses of morphine The Children's Hospital in Boston has, for some reason, an almost fixed rule against what I believe adequate doses of morphine You would be amazed at the infinitesimal doses they use and they look with distinct horror on larger doses But I do believe that children can stand larger doses of morphine In esophageal cases, I believe that one gets better relaxation under general anesthesia, and with the use of relatively small sized tubes one is far less likely to cause trauma than with the patient under local anesthesia We give practically all adults local anesthesia—a preliminary dose of morphine and scopolamine carried out with personal observation of the patient It is difficult to tell what a patient will do after a dose of morphine and scopolamine What will be a big dose for one will not have much influence on another The only way is to take time enough to try it on the patient and see the effect I have practically given up ether in adults I still retain it for esophageal work in children

DR L W DEAN, St Louis Chloroform and oxygen will cause relaxation just as well as ether and will not irritate the air passages In the absence of lesions of the brain, heart or kidney, chloroform and oxygen is the best anesthetic, provided one is sure to prepare the patient from a metabolic standpoint by the feeding of sugar, etc, so as to obviate the changes in the liver which may follow chloroform anesthesia

Dr McGinnis spoke of having had two deaths, one following chloroform anesthesia When one uses chloroform for a general anesthetic one should be sure to keep in mind the pharmacologic action of chloroform and epinephrine when used at the same time If one uses a little epinephrine on an animal and then administers chloroform, the animal will die almost instantly, and the same is true of the human being We should not use chloroform and epinephrine together

DR HARRY L BAUM, Denver I have nothing particularly new to add to the discussion of the paper, but in my own practice for a good many years it has been the rule never to use general anesthesia except in cases of intractable patients and in cases of sharp, impacted foreign bodies in the esophagus In children, ether is seldom necessary even with sharp foreign bodies in the esophagus In my own experience, open safety-pins in children are usually removed without anesthesia In adults, I use no anesthesia except preliminary morphine and hyoscine I learned that many years ago from Dr Eugene R Lewis, and have continued to practice it with uniform satisfaction I give my adult patients, for both bronchoscopy and esophagoscopy—with the exception of sharp impacted foreign bodies in the esophagus—a preliminary dose of morphine and hyoscine This results in the relaxation and freedom from dread, which are so essential in these cases I usually give these patients only the preliminary hypodermic the first time if repeated bronchoscopy is necessary After the first bronchoscopy in adults, it is not necessary to give further doses of morphine and hyoscine They have had the experience, they are more or less trained and one can proceed without anesthesia There is one exception, and that is when there is a violent cough I use a very weak cocaine solution in the trachea Usually a 1 per cent solution abolishes the cough reflex nearly as quickly as 10 per cent, and it is safer Dr McGinnis made one statement that does not agree with my experience, to the effect that he had freedom from cough under general anesthesia I have found in the few intractable cases in which I have used ether narcosis that the cough still persisted even with complete narcosis In those cases I have used sparingly a 1 per cent solution of cocaine, and I have been struck with the simplicity of the method and the results secured It is not original, of course, but I find it practical

I have another use for cocaine that is similar and also satisfactory In doing laryngeal operations, either by the direct method or by suspension, in patients who require general anesthesia, I have found that under the anesthesia the cords do not relax, and here also I use this same method After the patient is anesthetized before proceeding with operative intervention, I touch the cords with a weak

solution of cocaine, wait a minute possibly reapply and perhaps reapply two or three times during the course of the operation. This enables me to proceed with satisfactory relaxation of the cords. I feel that it is entirely safe because of the small amount of the weak solution of cocaine used, and it facilitates intralaryngeal manipulation under ether.

DR EDWIN MCGINNIS. About a week before I came west I had a letter from Dr Emil Mayer, in which he said that in all the cases he had been able to find, and from the patients who had been sent to him as chairman of the committee on accidents following the use of local anesthesia, the trachea, bronchi and air cells would stand more cocaine than any other part of the anatomy.

I brought this subject before the society because I have been interested in what anesthetic to use in patients on whom I had to operate for the removal of foreign body or for laryngeal tumor. I have taken coins out of the esophagus without any anesthetic, and will continue to do so. I had a case a couple of weeks ago, in which a piece of peanut shell lodged in the larynx, which I removed without an anesthetic.

I have learned enough about ether anesthesia to realize that it has a certain, definite place. I do not worry about a patient getting worse under ether. Occasionally, the anesthetist gets worried, but as soon as we aspirate the excess secretion the patient improves and we have no difficulty.

I am glad that this paper brought out some discussion. I think that we know better where we stand. I am not going to give up general anesthesia, because, as Dr Mosher brought out, in cases of sharp-angled bodies it is better to have complete relaxation. Dr Tucker showed a tube for pushing a safety-pin down into the stomach and pulling it out through the tube. In that type of case, I should not be in favor of giving up the use of general anesthesia.

MIXED TUMOR OF THE PAROTID TYPE GROWING FROM THE POSTERIOR ASPECT OF THE THYROID CARTILAGE. REPORT OF A CASE. DR ROBERT C LYNCH, New Orleans

This article will be published in full in the March issue of the ARCHIVES

PERITRACHEAL ABSCESS. DR LYMAN RICHARDS, Boston

This article will be published in full in the March issue of the ARCHIVES

DISCUSSION

DR EDWIN MCGINNIS, Chicago. I had one case similar to that of Dr Richards—a patient with dyspnea, with an acute rise in temperature. We first did an intubation, but in a day or two decided to do a tracheotomy, with the same experience as Dr Richards'. Evacuation of pus occurred as soon as we cut down to the cartilage.

DR LYMAN RICHARDS. I want only to mention two points. First, we thought until we actually did the operation that we were dealing with a superficial laryngeal obstruction. Second, the presence of this apparent collection of fluid left some doubt as to whether or not the patient should be operated on. I think that it would have been disastrous if the patient had been operated on by thyroctomy, but at that time there was great uncertainty as to the nature of the roentgen shadow. One object I had in presenting the case was to show the complexity introduced by the roentgen observations.

CHANGES IN THE ESOPHAGUS SECONDARY TO CARDIAC AND AORTIC DISEASES. DR LEO G RIGLER and DR KENNETH A PHELPS, Minneapolis (by invitation)

This article appears in full in this issue, p 188

DISKS IN THE ESOPHAGUS. ANALYSIS OF FORTY-FIVE CASES. DR SIMON JESBERG, Los Angeles

This article appears in full in this issue, p 210

DISCUSSION

DR LOUIS H CLERG, Philadelphia This excellent paper recalls the case of a patient who came to the Bronchoscopic Clinic about two years ago, a boy 10 years of age, who was said to have a fifty cent piece in his esophagus. There was no question about it because the roentgen study revealed a large disk at the junction of the middle and lower thirds.

The history was that at the age of 5 the patient, now 10, was supposed to have swallowed a fifty cent piece. Unfortunately for the patient, the parents were advised to wait, also unfortunately, the roentgen study that was made apparently did not include the cervical esophagus. I am sure that the coin was in the cervical esophagus at that time. Nothing was done, the child continued to have difficulty in swallowing, and about a month before he was sent to us he developed symptoms referable to the respiratory tract. Dr Manges, who made the roentgen studies when the child was admitted, suspected an esophagobronchial fistula, and gave the child a barium mixture to swallow, the material went into the left bronchus as well as into the stomach, undoubtedly a fistula. It is also interesting to note that the patient had an empyema that had been drained and was still discharging. At the same time, there was a large inflammatory mass in the left lower part of the back. The child developed an acute respiratory infection and died. At the postmortem examination an opening was found in the esophagus which communicated with the left bronchus. It was about 2 by 1.5 cm, epithelization had taken place, and the coin, with a notch in its edge, corresponded to the fistula so that the edge of the coin could be seen from the left bronchus. A properly made roentgen study would have revealed the coin when it was swallowed five years previously.

DR CHARLES W BROWN, San Diego, Calif I have seen about twenty cases of disks, two of the kind Dr Jesberg speaks of and one with sharp edges, but I have never had one in the esophagus, they always lodged in the pharynx just above the cricopharyngeus. This might be due to the advice of the pediatricians in our town, who encourage the mothers to bring the children to us at once when a coin has been swallowed.

DR EDWIN MCGINNIS, Chicago I have had three cases simulating some of those that Dr Jesberg presented. The first patient was a youngster, 3 years of age, in northern Michigan, who had had a quarter in the esophagus for about twenty weeks. This child had been taken to a physician in the town who had some x-ray pictures taken, which were not very good, and the removal of the coin had been neglected. About this time, I happened to get my name in the *Chicago Tribune* and three or four days later I got a letter from the mother of this youngster saying that she was sure her baby had a coin in the esophagus but she could not get any one there to listen to her. I wrote her to bring the child to Chicago, where we had x-ray pictures taken which showed the quarter just above the cardia. We were able to loosen the coin on two sides where it had become embedded in the wall and removed it. Previous to removal of the coin, the child could be heard coughing all over the ward, but a few days after the removal the cough disappeared.

I saw another patient about two months ago who showed a disk in the x-ray picture at the sternoclavicular notch, but when we examined the youngster with the esophagoscope there was no coin, and when we examined the trachea, there was no coin. We took the child to the fluoroscopic room and since the disk was still there, took lateral pictures and decided that it was embedded in the wall between the esophagus and the trachea.

The last case I saw six weeks ago when a good surgeon showed me an x-ray picture of an Italian child, aged $2\frac{1}{2}$ years, with a disk at the usual site in the esophagus. He said that within a week three people had anesthetized the child on three occasions and worked an hour and a half, but that the coin was still in the esophagus. On examining the child I was surprised to find two or three holes in the posterior pharyngeal wall extending between the esophagus and the spinal column. It was easy to see the coin after I lifted up the esophagus and

though it was buried in the anterior wall it was easily removed with suitable forceps. The child lived only six or eight hours after the removal. It was a case of fatality due to ill advised attempts at removal.

DR LYMAN G. RICHARDS, Boston. In some of these cases, I find two elements. First, the tendency of the foreign body to hide in the posterior folds of the esophagus. It is not unusual to overlook them and hunt a considerable length of time before they are found. I have seen fatalities result from overzealous search for a coin which showed in the x-ray picture but was simply hidden in the posterior folds of the esophagus.

Second, I have been disappointed once or twice in looking for a coin which showed in the x-ray picture, due to failure to have fluoroscopy performed on the patient immediately before the operation. These coins will show in the esophagus at one time, and in twenty-four hours you cannot find them. I think that it is important to perform fluoroscopy on all these patients a short time before operation.

DR CHARLES J. IMPERATORI. I am glad to hear Dr. Richards recommend fluoroscopy previous to esophagoscopy. I have established a routine procedure that no patient shall go to the operating room—no patient with a disk or foreign body in the esophagus—without fluoroscopy, even though a roentgenogram was taken a few hours before.

I should like to ask Dr. Law if he could help us as to the localization of these foreign bodies, particularly when they are found in the outer wall.

DR FREDERICK M. LAW, New York. I think that these cases illustrate what I said yesterday—do not accept a poor or fairly good roentgenographic plate. Consider the roentgenologist as your assistant, but do not accept an inferior picture when it involves a question of surgical intervention. In one particular case mentioned here, the quality of the film was more important than the problem of treatment. The failure to locate the foreign body contributed to the death of the child. There is no reason why that disk should not have shown. A plate or film of a metallic substance in the neck that does not show the spinal column is of no use. If it is a nonopaque body it is different, but in this particular case the film did not show the spinal column, therefore, the disk did not show.

So far as locating the position of the foreign body is concerned, the fluoroscope is best. The stereoscopic roentgenogram is next. A combination of the two is really essential, but the location should be checked up by the fluoroscope just before an attempt at removal. It is a difficult problem and requires careful teamwork between the roentgenologist and the bronchoscopist. That is the only way for satisfactory localization.

DR SIMON JESBERG. Dr. Richards asked how I arrived at the conclusion that the disk was first in the esophagus and only recently penetrated into the trachea. A foreign body could not remain in the respiratory tract such a length of time without more respiratory symptoms. Examination of the tissues at autopsy, a photograph of which is shown in the slide, showed that a smooth epithelium-lined pouch is present in the esophageal wall. The slit where recent entrance to the trachea was established as well as the tracheal walls have granulations. This indicates that the disk was first in the esophagus and later in the trachea.

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CONTRIBUTIONS OF OTOLOGY TO NEUROLOGY¹

J. GORDON WILSON, M.D.

CHICAGO

Within the last decade the advances in otology have been especially marked along two lines, one of which derived its impetus from physics, the other, from the biologic sciences. The pioneer work of Seashore, who perceived the necessity of more accurately measuring and recording the minimum audibility of sound, produced the siren audiometer, which has been modified and improved during the intervening years. This was followed by the Western Electric audiometer from the scientific department of the American Telephone Company, whose investigations to perfect the methods of transmission of sound and especially of the voice resulted in several instruments for testing minimum audibility. From the biologic side, increased knowledge of the function of the ear has been especially associated with the names of Magnus and his co-workers in Europe and of Maxwell and others in this country. From these has come a clearer perception of the function of the complex vestibular mechanism, though we are far from having a full understanding of the action of the labyrinth and its intricate associations.

It is a matter of congratulation that in these investigations no mean share has been taken by the members of the American Otological Society. Not only have advancements along both of these lines been made by them but those made elsewhere have soon been brought to our attention, and members have been found capable of discussing them adequately, sifting the evidence presented and adapting them to their needs. In these the Society has justified itself as a forum at which advances coming from physics and biology can be viewed dispassionately and their practical applications defined. Frequently there has been a sharp divergence of opinion among the members but such was incidental to a free discussion, for

"There lives more faith in honest doubt
Believe me, than in half the creeds."

It has never been forgotten that the Society's chief object is to combat the diseases which directly or indirectly lie within its field. It has been recognized that progress necessitates keeping in touch with advances in other lines of medical research. This Society's actions in the past have demonstrated that it welcomes any source of knowledge

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Expansion of the presidential address before the American Otological Society.

that will make its members better acquainted with the structure and function of the ear. For a long time, otology lagged behind its sister specialty ophthalmology, and I am not sure that even now it is quite in line with it. But otologists are rapidly making up the leeway. When one considers the relationships of aural and vestibular function, in which disorder may cause bodily disturbances, it is obvious that one has to deal with a wider field than ophthalmology. The view that a specialty is a focusing of attention on a particular part is no longer held. Disease is not self-limiting. Obscure symptoms are often to be explained by the disturbance of the interrelationship of separate parts of the biologic entity even in a remote field. Disturbed reactions which occur spontaneously or which are artificially produced may be capable of explanation only on the understanding of fundamental relationships. This is true of the complex vestibular mechanism.

To have discussed recent advances, both auditory and vestibular in this paper would have gone beyond the limits I had assigned myself. I should have liked to appraise the advantage that has been derived from audiometry and to voice the feeling of regret that the early hopes of those who worked in this field have not come to full fruition. The audiometer of today has important limitations. I believe that the audiometer of the future will be more perfect, more easily workable and, it is to be hoped, less expensive. This is sure to come for there are enthusiastic workers who are discerning its shortcomings and insisting on their removal. I, however, shall discuss some contributions which otology has made to neurology by means of observations on the modifications of the vestibulo-ocular reflex in intracranial lesions.

VESTIBULO-OCULAR REFLEX

In order that man may keep himself in a definite attitude or posture relative to the world around him it is requisite that information of alterations of his posture such as occur during movements which he as a living organism carries out, be rapidly given, and that a neuromuscular mechanism can immediately call into play compensatory forces to enable him to retain the posture he has assumed or to return to normal. The forces he has chiefly to combat are gravitational or rotational. The informative impulses come chiefly from three sources: the ear, the eye and contact stimuli in joints and muscles. It is with the impulses from the ear, the vestibular afferents and the neuromuscular mechanism associated with them that this paper is concerned. These constitute the vestibular reflexes.

The vestibular reflexes are chiefly concerned with adjustments necessary to maintain an adequate posture in movements of the head. They are therefore tied up with certain muscle groups that are affected by movements of the head—the eyes, the neck muscles and, to a less

extent, the muscles of the face, the trunk and the limbs. I am here considering the first of these, the vestibulo-ocular, which is concerned with the adequate posturing of the eyes necessary to vision. This reflex has from the standpoint of diagnosis certain advantages.

- 1 The musculature of the eye is the most accurately balanced mechanism in the body and therefore one in which it might be expected that early disturbances of function would be recognizable.

- 2 It is easily observed, and the fundamental reflex (the slow deviation) is less influenced from other neural levels, especially the cortical, which lead, for example, to those modifications so disturbing in estimating the significance of the pointing error.

- 3 The vestibular reflex from the ear to the eye may be classed as a segmental reflex. It is a usable segmental reflex, just as is the knee jerk, and since its pathway is intracranial, it probably has greater diagnostic potentialities. As in no segmental reflex in man can one eliminate other neural influences, cortical or intersegmental, which normally or pathologically modify primary reflex action, so in the vestibular eye reflex there are such contaminating influences in cooperation or in antagonism which modify the impulse passing along the final common path, these have to be taken into account in the deductions drawn, e.g., in tumors of the cerebellopontile angle blocking the lateral recess (the foramen of Luschka) and causing auditory choking as well as cerebellar disturbance.

Abnormal changes in the primary vestibulo-ocular reflex produced by disease or by artificial stimulation of the end-organ are of value to help localize areas in which the disturbing factor is located. While I recognize that the available facts are often general and some are even open to dispute and that at present one lacks both physiologic and pathologic data to be dogmatic, yet I believe that there are sufficient data on some points to justify at least semiauthoritative statements.

The study of neuromuscular reactions from the labyrinth can be carried out in animals by destruction of the labyrinth or by artificial stimulation. Labyrinthine stimulation in man can be most easily produced by rotation, by the electric current or by changes of temperature. It is most common to employ water at a temperature of about 15°C. Such stimulation produces an oscillation of the eyes characterized by a slow deviation in one direction and a quick return to the opposite side, and it is this double movement that constitutes labyrinthine nystagmus as distinct from cerebellar nystagmus, to be referred to later. Destruction of the labyrinth or the action of cold water produces the slow deviation to the side affected. Hot water produces a slow deviation to the opposite side. In all of these reactions, there are conjugate movements of the eyes.

I have repeatedly pointed out that the terminology usually employed of naming the nystagmus from the quick component is unfortunate in that it tends to reduce to a position of secondary importance the essential factor in the movements, namely, the slow component,¹ the quick component follows and is complementary to the slow, and may be regarded as an attempted readjustment to normal. The results of this terminology have been unfortunate, and the misplaced emphasis should be discarded. This has resulted in faulty deductions in experimental work and a lack of perception of the slow drift and its significance so often seen in early lesions of the vestibular ocular path. However, it may be said that the significance of the slow component is gradually being recognized.

There are certain facts which in my opinion may be regarded as established

1 If the lesion is confined to the labyrinth, the essential point is the deviation of the eyes to the side of the lesion. This is followed by a quick return toward the midline. In this nystagmus there are points which may be of diagnostic importance, namely, that it is increased by looking to the side opposite the lesion and diminished on looking to the side of the lesion, also, while conscious effort can control the quick component and keep the eyes toward the side of the lesion (and diminish the vertigo if present) conscious effort has little or no effect on the slow component and cannot keep the eyes away from the side to which it is directed, such an attempt makes the patient more uncomfortable.

2 When the lesion is confined to the labyrinth the duration of the nystagmus is short, three or four days at most. I have, however, frequently reproduced it in animals several weeks after unilateral labyrinth destruction by placing the head in an abnormal position. Cerebellar nystagmus can persist for months and even years, in one of my cases it was apparent ten years after the injury. In short, *the loss of labyrinthine influence is quickly compensated, the loss of cerebellar influence is slowly, if ever, completely compensated*.

3 In lesions of the peripheral organ of the ear, the spontaneous vestibular reflexes observed are to be regarded as due to a loss of function and not to an increase of function, supposedly owing to irritation. If such an increase of function occurs, it must be rare, as I have never observed it. It would appear as a deviation of the eyes to the side opposite the lesion. Following a mastoid operation, especially in elderly

1 Wilson, J. G., and Pike, F. H. The Mechanism of Labyrinthine Nystagmus and Its Modification by Lesions in the Cerebellum and Cerebrum, XVIIth International Congress of Medicine, London, 1913, p. 563, Arch. Int. Med. **15**: 31 (Jan.) 1915.

people in whom the bone is sclerotic, one occasionally sees nystagmus lasting twenty-four or forty-eight hours which passes off without further disturbance. This, I believe, is due to labyrinthine disturbance and might be called an irritative lesion. But in no case have I seen the eyes deviated to the opposite side, the slow component is always to the side of the lesion, a depressive effect. After experimental destruction of the labyrinth in whole or in part in animals, as soon as the animal recovers from the anesthetic the spontaneous nystagmus observed indicates loss of function. Clinical cases have been recorded in which failure to recognize this has been followed by unfortunate results. In one such case, following acute inflammation of the left ear there was a slow deviation to the right and a quick return to the left, this was diagnosed as due to inflammatory involvement of the left labyrinth and not till five weeks later, when a choked disk resulted, was the patient operated on for left cerebellar abscess, as is explained further on.

OSCILLATIONS OF THE EYES FROM CEREBELLAR LESIONS

Nystagmus of cerebellar origin shows a slow deviation and a quick return in the horizontal plane. However, the essential point here is that a lesion of a lateral lobe of the cerebellum causes a deviation of the eyes to the side opposite the lesion. It will be noted that this is the opposite of what occurs in labyrinthine lesions. It is nearly twenty years since Dr. Pike and I demonstrated this experimentally in animals, at the same time showing that the vestibular ocular path does not pass through the cerebellum.² The latter is now usually conceded, though the deviation appears to be overlooked.

This deviation in man has frequently been observed, though not always so interpreted. It is clearly brought out in a case quoted by Ingvar,³ of a definitely localized metastatic tumor in the right lobus biventer of the cerebellum, in which there was horizontal nystagmus, slow to the left and quick to the right. One rarely has an opportunity of seeing so clearly a defined case. The following, however, which helps to define my position, is not uncommon.

CASE 1—Joseph H. was admitted to Wesley Hospital, Dec. 14, 1925, in the service of Dr. Kanavel and Dr. Loyal Davis, with the complaints of vertigo, staggering gait with broad base, ataxia, blurring of vision, no motor involvement, no sensory disturbance and deafness in the right ear. There was occasionally spontaneous nystagmus on looking forward, with slow deviation to the left.

When the patient looked to the right, the nystagmus was slow to the midline, of the cerebellar type, as is shown further on. When the patient looked to the left the deviation was slow to the midline, of the labyrinthine type.

² Wilson, J. G., and Pike, F. H. The Effects of Stimulation and Extirpation of the Labyrinth of the Ear, and Their Relation to the Motor System, *Experimental, Philosophical Transactions of the Royal Society of London* **203** 150, 1912.

³ Ingvar, Sven. On Cerebellar Localization *Brain* **46** 321, 1923.

At operation, a capsulated tumor of the right lobe of the cerebellum, in close apposition to the pons, was found

This difference in direction of the slow phase is not due to a break in the primary vestibulo-ocular path, for this pathway does not pass through the cerebellum. The explanation is not known nor is its location definitely settled. It does not appear to me to be due to injury of the cerebellar cortex, even in its anterior part, for in animals I have repeatedly removed various parts of the cortex without producing it but it does follow when the cerebellar nuclei are injured. As a result of many observations my present hypothesis is that it is due to a loss of cerebellar influence on the vestibular nuclei of the same side, that is, it is a depressive and not an irritative effect.

To complete the picture of cerebellar nystagmus there must be superadded to this an ataxic movement of the eyes on looking to the right or to the left, increased by fixation. Dr. Pike and I pointed this out in 1912, and it has received abundant confirmation by Gordon Holmes and others.⁴ This is the most distinctive feature of the nystagmus due to cerebellar lesions and justifies the term cerebellar nystagmus. During the World War I had the opportunity of studying several such cases, in particular that of Private B, whom I saw five months after he received a shrapnel wound of the left cerebellum.

CASE 2—Private B, aged 30, was examined on Sept. 1, 1916. He had been wounded by shrapnel on April 6, 1916. The entrance wound was 1.5 cm. above and to the left of the occipital protuberance. The exit scar was 3 cm. posterior to the left external auditory meatus. The patient complained of headache and vertigo. The hearing was normal in both ears. When the eyes were examined it was noted that there was no nystagmus on looking forward, on turning the eyes to the left there was a slow drift to the midline and a quick jerk back. When an object was fixed to the left, there were pendular horizontal oscillations, that is, oscillations showing no distinct quick and slow components. Then after from two to five seconds came the roll to the midline followed by the quick jerk back for fixation. The pendular oscillations again appeared, followed at a brief interval by the roll to the midline.

On looking to the right, there was a roll to the midline and a quick jerk back. When an object was fixed to the right, less marked but rapid pendular oscillations were seen, followed at a much shorter interval by the roll to the midline. On looking up and to the left, on fixation, the oscillations were present. On looking up and to the right, the eyes on fixation were steady.

In all positions the oscillations were diminished or disappeared when lenses of 18 diopters were placed before the eyes, thus diminishing fixation.

The nystagmus was always horizontal. As the fixation approached direct forward vision, the pendular movements became finer till they faded away. I saw this patient again in 1926 when he was working daily. The nystagmus was still present and showed the same characteristics.

4 Wilson and Pike (footnote 2), *Relation of the Labyrinth to the Cerebrum and Cerebellum*, *Tr. Am. Otol. Soc.* 1914. Holmes, Gordon, *The Symptoms of Acute Cerebellar Injuries Due to Gunshot Injuries*, *Bram* 40:461, 1917.

The pendular movements on turning the eyes to the right and left on fixation are obviously of an ataxic nature and are more marked on looking to the side of the lesion. They persist for a long period even after the patient appears otherwise well and able to work. The ataxic component can be reduced or eliminated by glasses with lenses of 18 diopters. It will be noted that the pendular oscillations are more marked on looking to the side of the lesion and may be noticeable only then. In these respects, the movements are in distinct contrast to vestibular nystagmus.

LESIONS NEAR THE MESENCEPHALON

A lesion in or near the mesencephalon involving this area by direct or indirect pressure is often marked by a vertical nystagmus. It is in such lesions that one also gets dissociation of eye movements and such abnormal caloric reactions as perverted nystagmus.

Vertical Nystagmus—Experimentally, the only location in dogs and monkeys in which I have consistently seen vertical nystagmus is in the region of the mesencephalon. This seems in agreement with the work of Ferrier, Adamuk, and others.⁵ One not infrequently sees clinical cases of otitic meningitis or encephalitis in which as the inflammation spreads forward, the horizontal nystagmus becomes associated with, or even displaced by, a vertical component.

CASE 3—Dorothy L., admitted to Wesley Hospital in October, 1923, on the service of Dr. Kanavel, became ill with diplopia three months before admission, though headache, vomiting or optic neuritis were not present. She walked with a spastic, ataxic, hemiplegic gait, and staggered to the left. There was no evidence of auditory defect. There was paresis of the left fifth motor nerve, and of the sixth and seventh. Movements of the right hand were clumsy and paretic.

Spontaneous nystagmus was present. When the patient looked forward, the eyes at times rolled to the left. When she looked to the right and left, the movements were slow to the midline and quick back, of labyrinthine type. When she looked up, the movements were slow down with a quick jerk back, which was very noticeable.

The caloric test (cold) in both ears easily produced nystagmus. When the test was made in the right ear, the eyes rolled to the right with a quick jerk back, but deviation was more marked than the quick return, the left arm (nonparetic) showed little pointing error. When the test was made in the left ear, the right eye was fixed to the left, this increased when the head turned back, there was a pointing error to the left.

At postmortem, a glioma involving the upper part of the brain stem was found. The cerebellum was normal.

Dissociation of Eye Movements—I have seen unilateral nystagmus in dogs after medial section of the brain stem. Experimental injury to the corpus quadrigeminum of the side to which the slow deviation of

⁵ Sherrington in Schafer. Text Book of Physiology, London 1900, p. 912.

the eyes is directed does not abolish the nystagmus either in its slow or in its quick phase but it does bring about dissociation of the eye movements⁶

CASE 4—Mrs B S was admitted to Wesley Hospital in June, 1926, on the service of Dr Kanavel and Dr Davis. On examination, it was difficult to elicit information from her, she did not hear well and was mentally embarrassed. She complained of frontal headaches, difficulty in walking, falling to the right, vertigo, with occasional vomiting, and sensation of rotation to the right. Her position in bed had no effect on the vertigo. There was tinnitus in both ears.

The drum membrane in both the right and the left ear was normal. A whisper could be heard at 3 feet with the right ear and at 1 foot with the left. Hearing for the C fork was reduced 50 per cent in the right ear and 70 per cent in the left.

Both hands when held out deviated to the right. The left hand went down, the right hand up. On pointing, there was a marked deviation of the left hand to the right. The right hand pointed accurately.

There was paresis (partial paralysis) of both external recti. The left eye tended to deviate in. There was a unilateral nystagmus in the right eye, with a quick movement to the left, a slow movement toward the right going only slightly beyond the midline. The nystagmus in the right eye was marked on looking to the left, and at the same time a slight nystagmus was seen in the left eye, with a slow roll to the midline. No movement of the eyes upward was possible, when the patient was told to look up both eyes rolled in. She could move the eyes slightly downward.

In the caloric test of the left ear, reaction was produced with 2 ounces (59.2 cc) of water at 14 C. The deviation was to the left, with a marked tendency of the right to turn in. The slow component was much more prominent than the quick component. The noticeable point was the strong roll in of the right eye to the left, with a strong rotatory component not present in the left. The pointing error was to the left, with vertigo.

In the caloric test of the right ear, a reaction was produced with 5 ounces (148 cc) of water at 14 C. The deviation was normal, to the right. The right eye was markedly turned to the right, and the excursion of the nystagmus was wider than in the left eye. Even several minutes after the caloric test was stopped, the right eye was turned in to the right. The pointing error and vertigo were normal.

The condition was diagnosed as tumor of the midbrain, probably pineal in origin.

LESIONS ABOVE THE MESENCEPHALON

As the primary reflex vestibulo-ocular path is not interfered with, there is as a rule no labyrinthine nystagmus. Oscillations of the eyes have been described. I have seen them, but they were inconstant and tended to be of the pendular type. It appears to me however, that there is frequently a change of the vestibular reaction from caloric stimulation of the ear both quantitative and qualitative. The quantitative change is indicated by (a) the rapidity with which the caloric

⁶ Wilson and Pike (footnote 1). Luciani. Human Physiology, London, 1919, vol 3, p 518. Sherrington (footnote 5).

reaction comes on, (b) its long duration, (c) the rapidity of the oscillations, (d) the severity of the malaise which accompanies it—vertigo and vomiting. I have found such quantitative changes not only in intracerebral lesions but in cases of psychoneurosis with vertigo as a complaint, or in minor vestibular disturbances in which the symptoms of vertigo appeared unduly predominant. The following cases illustrate the quantitative changes.

CASE 5—Marvin P., aged 21, was admitted to Wesley Hospital, on the service of Dr. Loyal Davis, in February, 1928, with the complaint of occipital headaches and loss of vision. On examination, the patient was alert and intelligent; there was no anosmia, visual acuity was completely lost, he was unable to recognize the light thrown into his eyes by a flashlight, no sensory or motor symptoms, no ataxia and no dysmetria were present. Hearing was normal, there was no tinnitus, nystagmus or vertigo.

The caloric test in the right ear (4 ounces [118.4 cc.] of water at 15 C.) produced violent and prolonged nystagmus slow to the right, vertigo, nausea, marked excitement and fainting. The test in the left ear (3½ ounces [104 cc.] of water at 15 C.) caused violent and prolonged nystagmus, slow to the left, great distress and excitement, nausea and vomiting.

(NOTE—At this temperature, the average amount of water used to produce the caloric reaction is 7 ounces [207 cc.])

At operation, a tumor lying between the posterior limbs of the chiasma and apparently coming from the region of the third ventricle was found.

CASE 6—Mrs. R. H., aged 21, was admitted to Wesley Hospital in April, 1928, on the service of Dr. Loyal Davis, with the complaint of occipital headaches with vomiting, and of walking as if she were drunk, but no vertigo.

Examination revealed bilateral papilledema, no nystagmus and no sensory or motor disturbances, except with the left arm, which was clumsy and showed dysmetria and adiadokokinesis.

The audiometer chart showed hearing in the right ear to be fairly normal, and a marked defect in the left ear. The patient appeared in a stuporous condition. Tinnitus was present in the left ear. There was no nystagmus. When the patient was in the Romberg position, she fell back.

The caloric test in the right ear (2 ounces of water at 14 C.) produced pronounced nystagmus, slow to the right, a pointing error to the right and vertigo. The test in the left ear (1½ ounces [45 cc.] of water at 14 C.) caused marked nystagmus, slow to the left, pointing error and vertigo.

At operation, the cerebellum was normal, nothing abnormal was found in the posterior fossa, the lesion was not located, but the roentgenograms indicated a tumor in the region of the pituitary.

CASE 7—Edward L., aged 39, was admitted to Wesley Hospital in December, 1926, on the service of Dr. Loyal Davis, with the complaints of parietal and frontal headaches and projectile vomiting; there were no vertigo, disturbance of equilibrium or motor or sensory symptoms. Bilateral papilledema was present. The patient was alert and intelligent. There were no cerebellar symptoms.

Hearing in both ears was normal, there was no tinnitus, spontaneous nystagmus or pointing error.

The caloric test in the right ear (3 ounces of cold water) produced nystagmus, slow to the right and of long duration, normal pointing error and pronounced

vertigo The test in the left ear (7 ounces of cold water) caused normal nystagmus, slow to the left, normal pointing error and vertigo

A note was added as a result of these observations that the tumor probably lay above the midbrain and on the right side

At operation, no cranial tumor could be located, but the right ventricle gave a cloudy opaque fluid and the left a clear colorless fluid

A qualitative change can be observed at times following caloric stimulation in lesions immediately above the mesencephalon In these cases, following the caloric reaction in each ear, there is either a falling out of the rapid phase on one side or such a disproportionate persistence of the slow phase as to attract attention It is unfortunate that the clinical significance of this has been lost in the physiologic controversy of the origin of the quick phase

CASE 8—Clarence W, aged 44, was admitted to Wesley Hospital in April, 1924, on the service of Dr Hamill, with the complaint of bitemporal headaches with nausea and vomiting There was no vertigo Papilledema was present in both eyes and slight tinnitus in the left ear Hearing was diminished in both ears but chiefly in the left, the deafness was of the nerve type The Rinne test was positive in both ears, the Weber test was referred to the right, bone conduction was diminished There was no pointing error, the patient tended to fall to the left, if the hands were held out, the left fell down and out There was no spontaneous nystagmus on looking forward or to the right or left On looking up, there was a slow drift down

When the caloric test was made, the patient was in bed, and was weak and mentally dull The reaction was easily produced with cold water in both ears When the test was made in the right ear, the eyes deviated to the right but with no quick return In the left ear, it gave rapid oscillations of the eyes in which no quick or slow phase could be differentiated If the patient looked to the left, this was diminished If he looked to the right, the nystagmus assumed the vestibular type (slow, quick)

At postmortem examination, a glioma of the inferior horn of the right lateral ventricle was found involving the sublenticular part of the internal capsule Similar cases have been observed by others, e g Jones and Fisher⁷

My interest in this subject was aroused by the results of experimental work that Dr Pike and I carried out on dogs and monkeys, first published in 1912 In this article the results of our experiments on the removal of a cerebral hemisphere "suggested to us a cortical mechanism affecting the nystagmus"⁸ Subsequent experiments confirmed this We found that if a cerebral hemisphere is removed more or less completely especially if the region involved is internal to the temporal lobe, stimulation of the labyrinth on the side of the lesion with cold water gave deviation of the eyes and either no true nystagmus or altered phasic

⁷ Jones, I H, and Fisher, Lewis Equilibrium and Vertigo, Philadelphia I B Lippincott Company, 1918, p 444

⁸ Wilson and Pike (footnote 2, p 152)

time and that stimulation of the same labyrinth with hot water gave normal nystagmus

The deductions we made were (a) Lesion of a cerebral hemisphere on the side to which the slow component is directed abolishes or reduces the quick component (b) There is a location above the mesencephalon from which the quick component comes or which influences its occurrence

The following experiments by Dr Pike and myself exemplify our contentions

The left temporal lobe in a monkey was removed on June 17 1913

On June 18 there was paresis of the right limb The eyes were freely movable in all directions but tended to move to the left Rotation to the right showed after-nystagmus, slow to the right, quick to the left, with a duration of twenty-eight seconds On repeated rotation there was an after-nystagmus of thirty-two seconds On rotation to the left, after-nystagmus gave a violent movement of the head, with oscillation of the eyes lasting about sixteen seconds

On June 19, when the right ear was irrigated with cold water, vigorous nystagmus slow to the right and quick to the left occurred When the left ear was irrigated with cold water, nystagmus was slow to the left, with a slight irregular quick jerk back Irrigation of the right ear with hot water produced the same type of nystagmus as that elicited with cold water, it was marked, and in the same direction (a reversal effect)

On June 20 irrigation of the left ear with cold water showed deviation to the left but no nystagmus Irrigation of the right ear with cold water produced deviation to the right, with marked nystagmus The left ear, irrigated with hot water, produced slight but marked nystagmus Irrigation of the right ear with hot water caused deviation to the left, but no nystagmus

The animal lived for several weeks, and on July 9 the same results were obtained At postmortem examination, the left temporal lobe and the adjacent part of the cerebrum were removed, the left thalamus was slightly damaged

On April 10, 1913, the right cerebral hemisphere of a dog was removed A trephine opening was made preparatory to destruction of the left labyrinth The dog was allowed to recover from the ether anesthesia

When the left trephine opening was irrigated with cold water, nystagmus was slow to the left and quick to the right Hot water in the left trephine opening produced strong deviation to the right, and no quick jerk back At postmortem examination, the right hemisphere was completely removed, involving the right thalamus A blood clot was found in the cranial cavity extending under the pons and medulla

The clinical significance of these observations has been obscured by the question of the location and mechanism of the quick phase Any discussion of this subject would obscure my main proposition that the mechanism of nystagmus involves an area above the mesencephalon, and that there is frequently a qualitative and quantitative reaction to caloric and rotational stimulation to be demonstrated in cerebral lesion As further evidence of this, I quote the results obtained by de Barenne

and de Kleijn⁹ in their study of vestibular eye reflexes following destruction of a cerebral hemisphere in rabbits. They summarized their results as follows:

After extirpation of one cerebral hemisphere (for instance, the left) one notes

(a) With simultaneous irrigation of both auditory canals with cold or warm water, no nystagmus sets in.

(b) The Nachnystagmus after right rotation, the cold water nystagmus with the irrigation of the right auditory canal, that is, a nystagmus with rapid component toward the left is stronger than the nystagmus when the opposite stimulus is used, that is, a nystagmus with rapid component toward the right.

(c) In a rabbit with, for instance, a left sided labyrinth extirpation in which therefore only one labyrinth is working the Nachnystagmus, after extirpation of the left cerebral hemisphere and in spite of the left labyrinth extirpation, is nevertheless stronger after right rotation than after left.

Results obtained by Bauer and Leidler¹⁰ also lend support to this. They made the following experiment on a rabbit:

KANINCHEN 13—1 März Extirpation der Rechten Grosshirnhemisphäre (Vordere und seitliche teilweise auch hintere Partien) 5 mal nach rechts 6 Zuckungen, 5 mal nach links 4 Zuckungen 10 mal nach rechts 6 Zuckungen, 10 mal nach links 14 Zuckungen Querschnitt durch das ganze rechte Gehirn vor den Vierhügeln 5 mal nach rechts 6 Zuckungen, 5 mal nach links, 3 Zuckungen 10 mal nach rechts 4 Zuckungen, 10 mal nach links 21 und 46 Zuckungen

3 März 5 mal nach rechts 5 Zuckungen, 5 mal nach links 27 Zuckungen

Zweite Operation—Fortsetzung der Extirpation des rechten Grosshirns 10 mal nach rechts 14 Zuckungen, 10 mal nach links 22 Zuckungen Entfernung der hintern Partien der Hemisphäre bis an die Basis 5 mal nach rechts Einstellung nach rechts, dann 6 typische Zuckungen 5 mal nach links 15 sehr kleine Zuckungen

I believe, and have so stated, that the primitive vestibular mechanism persists in all vertebrates, but in higher vertebrates there is an ever increasing association with centers above the mesencephalon. This does not mean a retrogression of the vestibular system in man but a higher degree of adaptability on the part of a more complex motor system. I do not say that the red nucleus and the cells that extend from these to the medulla may not act in part as Magnus outlined¹¹. All I plead for is the consideration of the possibility that some part of the function

9 De Barenne and de Kleijn Ueber vestibuläre Augenreflexe V Vestibularuntersuchungen nach Ausschaltung einer Grosshirn-hemisphäre beim Kaninchen, Arch f Ophth **111** 391, 1923

10 Bauer and Leidler Einfluss der Ausschaltung verschiedener Hirnschnitte auf die vestibulären Augenreflexe, Arb a d neurol Inst a d Wien Univ **19** 206, 1912

11 Magnus and de Kleijn Experimentelle Physiologie des Vestibularapparates bei Säugetieren mit Ausschluss des Menschen, Handbuch der Neurologie des Ohres, 1923, vol 1, p 465

of these areas has been transferred in man to other and higher areas or, at any rate, that profound influences above the midbrain are to be considered. I believe that one should not forget that other modifications have already occurred in the vestibular system, and that one should not be too dogmatic in transferring experimental data from rabbits to man. This is in keeping with the phylogenetic development of the brain. To explain the facts observed as a phase of cerebral inhibition seems but to strengthen the argument for such a transference. What does a cerebral inhibition imply? The physiologist cuts off the so-called inhibitory influence and then considers only the effect of its absence on a center which probably, because of this cut-off, has augmentation of afferent forces from other sources. What was cerebral inhibition doing before it was cut off? Inhibition is a positive and not a negative quantity. Suppose an inhibitory center *A* in the cerebrum is controlling the red nucleus. To do so adequately, Center *A* must get information from the periphery concerning equilibrium, and therefore peripheral influences must pass up higher than the brain stem, and interference with them may modify the vestibular reflex. That recognizable modifications of the vestibular ocular reflex can be produced by cerebral lesions appears evident from the foregoing experimental and clinical data. Their applicability in diagnosis appears to me of importance. One can afford to wait for the physiologic explanation.

SUMMARY

- 1 The vestibulo-ocular reflex shows early disturbance of labyrinthine function
- 2 A lesion of the labyrinth results in loss of function, shown by slow deviation to the side of the lesion with quick return to the opposite side
- 3 A lesion of a lateral lobe of the cerebellum results in slow deviation to the side opposite the lesion and quick return to the side of the lesion
- 4 In cerebellar lesions, there is an ataxia of the eye muscles on fixation, most marked on looking to the side of the lesion
- 5 Differential diagnosis of labyrinthine and cerebellar lesions can be aided by a comparison of the lesions mentioned in paragraphs 3 and 4 though these may be obscured by lesions affecting both
- 6 Loss of labyrinthine function is quickly compensated, loss of cerebellar function is slowly if ever fully compensated
- 7 Intracranial lesions near the midbrain are marked by vertical nystagmus and dissociation of eye movements (unilateral nystagmus, abnormal caloric reactions, etc.)

8 Intracranial lesions above the midbrain do not interfere with the vestibulo-ocular reflex but at times give a qualitative and quantitative change in the vestibulo-ocular reflex from caloric reaction, and rotation

9 Cerebral inhibition can control nystagmus (certainly the quick phase) and this suggests a center above the midbrain receiving information from the periphery

POSTTONSILLECTOMIC PULMONARY ABSCESS

MEDICAL ASPECTS *

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Posttonsillectomic pulmonary abscess is that condition of the lungs characterized by consolidation and necrosis which follows shortly after the removal of tonsils. Consolidation and abscess are possibly different stages of the same process, and hence many so-called ether pneumonias might be included in this study.

ETIOLOGY

The complication generally begins from twenty-four to forty-eight hours after operation and is characterized by fever (sustained or hectic), sweats, anorexia, malaise and a dry harassing cough terminating, in from ten to fourteen days, with foul expectoration. Much discussion has arisen regarding the cause of this pneumonic process and its advanced stage of necrosis. Both the aspiration and the embolic theories have certain arguments in their favor, and I shall summarize them as concisely as possible.

Aspiration—This seemed the most logical theory for many years, because mucus and blood from the mouth have been found in the trachea and larger bronchi by bronchoscopy after tonsillectomy. According to a statement by Fischer,¹ Myerson studied 200 patients after tonsillectomy under general anesthesia and found blood and mucus in 155, although none of this series developed pulmonary abscess. Motor driven forms of apparatus for administering general anesthesia had been blamed for blowing the pharyngeal contents into the trachea. Experimenters, however, have pushed pyogenic material into the bronchi and injured the walls in the hope of producing infection. Septic material has been injected into the peripheral pulmonary tissue by a needle thrust between the ribs, but without the production of disease. In 1927, Smith² reported that he was able experimentally to produce abscesses by the following technic. Bloody scrapings from teeth afflicted with pyorrhea, showing microscopically spirochetes, fusiform bacilli and

* Submitted for publication, Nov. 18, 1929.

* Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, July 6, 1929.

¹ Fischer, A. E. The Pulmonary Sequelae of Tonsillectomy in Children, *Am. J. M. Sc.* **176** 253, 1928.

² Smith, D. T. Experimental Aspiratory Abscess, *Arch. Surg.* **14** 231 (Jan.) 1927.

cocci, were slowly injected into the trachea of guinea-pigs, rabbits and mice, 50 per cent developed pneumonia and 20 per cent abscesses, and 30 per cent escaped disease, possibly owing to acquired resistance. Crowe and Scarff³ produced pulmonary abscesses in dogs by placing a plug of cotton, saturated with spirochetes, etc., from pyorrheal scrapings, in a bronchus, but they were unable to find the disease when the plug was saturated with pneumococci, streptococci, staphylococci and colon bacilli. They also obtained the same type of abscess by placing the spirochetal plug in the frontal sinuses of two dogs, and concluded that the ensuing infection was aspirated into the lungs during sleep. Allen's⁴ experiments with pus from a human bronchiectatic cavity showed that the spirochetes, if exposed to room temperature, die in about thirty minutes while if the transfer is made to dogs at once, abscesses result, furthermore, that if the spirochetal infection is "trapped" in the smaller bronchi, abscesses develop. The reason that aspirated material does not always cause disease is that cough, ciliated epithelium and wandering cells in the blood get rid of much infection before trouble results. Kline⁵ produced gangrenous pulmonary lesions in rabbits by intratracheal injections of spirochetes and fusiform bacilli from the sputum of a gangrenous pulmonary abscess and from carious teeth. Aschner,⁶ in reviewing ten cases of bronchiectatic abscesses following tonsillectomy under general anesthesia, expressed his belief that they begin as a bronchial infection and spread into the pulmonary tissue. Furthermore, the fact that thrombi were present in the pulmonary veins and not in the pulmonary arteries is evidence against the embolic etiology of pulmonary abscess. Experimentally, if the pharynx and base of the tongue have been deeply anesthetized and the swallowing reflex abolished material from the mouth will flow directly into the lungs. This has been seen in injections of iodized poppy seed oil 40 per cent. From this one can see that aspiration of material from the mouth does occur during or after tonsillectomy and that experimentally it has produced abscesses. But as Schlueter and Weidlein⁷ and others suggest, it may require "preexisting pulmonary disease, irritation from the anesthetic, old age and debility" to produce the pneumonia or abscess.

3 Crowe, S. J., and Scarff, J. E. Experimental Abscess of the Lung in the Dog, *Arch Surg* **16** 176 (Jan) 1928

4 Allen, D. S. Etiology of Abscess of the Lung, Experimental and Clinical Studies, *Arch Surg* **16** 179 (Jan) 1928

5 Kline, quoted by Schlueter and Weidlein (footnote 6)

6 Aschner, P. W. The Pathology of Lung Suppuration, *Ann Surg* **75** 321, 1922

7 Schlueter, S. A., and Weidlein, L. F. Post-Operative Lung Abscess. An Experimental Study, *Arch Surg* **14** 457 (Feb) 1927

Embolism—Holman, Chandler and Cooley,⁸ Cutler and Holloway⁹ and Schlueter and Weidlein⁷ have produced pulmonary abscesses in practically all their experiments by setting free infected emboli in the jugular vein. Cutler showed that if the infected thrombus remained in the vein of its recipient for forty-eight or more hours, the pulmonary disease resulting from its mobilization was often a pneumonia of varying degree, while those thrombi of a shorter duration produced abscesses. The same was true if the embolus was transferred to another animal. From this he concluded that the virulence of the organism was lowered by its stay in the host. Furthermore, if the animals were protectively vaccinated, the disease caused by the embolus tended to heal much more than in the unprotected animals. Further evidence in favor of the embolic theory is that several observers have noted a greater percentage of pulmonary complications when local than when general anesthesia was used. Grégoire noticed pulmonary complications in 9 per cent of patients operated on under local anesthesia, and Mandl reported in hemorrhoid operations more pulmonary complications under local than under general anesthesia but the reverse after goiter operations. The advocates of this theory also emphasize the fact that a high percentage of abscesses follows operations in potentially infected fields and also the greater percentage of abscesses following operations in mobile operative areas such as the throat. Schlueter and Weidlein compiled reports of 1,908 pulmonary abscesses, they found that 29.61 per cent were postoperative and that one half of these were post-tonsillectomic. Morrison¹⁰ reported 241 pulmonary abscesses investigated, 40, or 16.5 per cent, being postoperative and 20, or 8.3 per cent, post-tonsillectomic. In the present series of 42 abscesses (12 more than previously reported¹¹), 18, or 44 per cent, were postoperative and 8, or 19 per cent, were post-tonsillectomic. Lyman reported 20,000 tonsillectomies under nitrous oxide anesthesia without a single known abscess, Hedblom, 20,000 at the Mayo Clinic, with 2 known abscesses, Moore, 450,000, with 202 abscesses and Herb, 12,045 tonsillectomies under general anesthesia, with 2 abscesses. At Stanford University, Dr. Sewell's department has not noted an abscess in many years. The foregoing data should all be

8 Holman, E., Chandler, L. R., and Cooley, C. L. Experimental Studies in Pulmonary Suppuration, *Surg. Gynec. Obst.* **44** 328, 1927.

9 Cutler, E. C. Postoperative Abscess of the Lung, *Proc. Inst. Med.* **6** 199, 1927. Holloway, J. W., Schlueter, S. A., and Cutler, E. C. Relation of Immunity to the Experimental Production of the Abscess of the Lung, *Ann. Surg.* **86** 165, 1927. Cutler, E. C. The Etiology of Post-Operative Abscess of the Lung, *Ohio State M. J.* **24** 109, 1928.

10 Morrison, L. F. M. Pulmonary Abscess Post-Operative, *California & West Med.* **27** 792, 1927.

11 Pierson, Philip H. Non-Tuberculous Pulmonary Suppuration, *California & West Med.* **27** 4, 1927.

qualified with the adjective "known," for in large series some patients obtain treatment for this complication from some unknown source. It can be considered definitely an unusual complication in view of the large number of operations performed.

BACTERIOLOGY

The records on this subject are somewhat vague, and this may be explained on two grounds. 1 The study is often made by inexperienced bacteriologists who report the bacteria found in a chance loop of sputum and fail to appreciate the fact that the spirochetes are often present in minute whitish-yellow globules. 2 As these anaerobes do not grow except when specially planted, cultures merely enumerate the organisms found on the surface of the mediums. Besides the common organisms, such as different forms of streptococci, staphylococci, diplococci, etc., some careful observers have frequently found spirochetes, fusiform bacilli, vibrios and cocci, especially at the time when the sputum was foul. In the present series, in almost all cases is reported a predominance of a gram-positive diplococcus appearing in clumps or short chains. In only one was the fusiform bacillus mentioned. I emphasize this point somewhat, for in all probability the foul odor so frequently encountered is due to the spirochetal group mentioned and not to the aerobic group. Possibly the complication would be pneumonia if the aerobic bacteria alone were present, as the anaerobes account for the abscess formation.

SYMPTOMS AND PHYSICAL SIGNS

Some authors have tried to differentiate the type of abscess—*aspiration* or *embolic*—by the history. A constant dry cough beginning at once after operation suggests an aspirated foreign body. The complication beginning suddenly with sharp pleuritic pain suggests an embolus. In general, cough, which at first is dry, begins between the third and seventh day and by the tenth to fourteenth day is productive of foul sputum, often in considerable amount and frequently mixed with blood. Accompanying the cough and expectoration there are generally the following symptoms in the order of their occurrence: malaise, chills, fever, sweats, pain in the chest, anorexia and loss of weight.

Physical signs are remarkably absent even in well developed disease. This is easily explained, because the process is generally separated from the visceral pleura by a cushion of relatively normal lung. Dulness is the most constant sign. Often diminished harsh breath sounds are all that accompany this. Whispered voice is increased, and occasionally a few postexpiratory cough râles are heard. When the disease has gone

on to an advance stage of cavitation, cracked pot resonances and amphoric whisper may be present

DIAGNOSIS

The early diagnosis of pulmonary abscess is often made on the history which is most important, the paucity of physical signs compared with those present over a tuberculous area of the same size, the roentgen appearance and the laboratory observations of leukocytosis, sputum negative for tubercle bacilli and sometimes containing elastic fibers, and the objective signs of cough, fever, elevation of pulse rate and varying degrees of prostration. The differential diagnosis must consider pneumonia, an exacerbation of tuberculosis, neoplasm causing broncho-stenosis with infection distal to the obstruction, and granulomas such as coccidioidal, etc

TREATMENT

The treatment begins as soon as the diagnosis is made and calls for the closest cooperation between the bronchoscopist, surgeon and internist, a team that must work in perfect harmony. Miller¹² spoke of this as a "system of management" rather than a "method of management." Intensive medical treatment will result in cure in about 50 per cent of the cases. By medical treatment I mean absolute rest in bed, with abundant fresh circulating air, high caloric diet and postural drainage. Pritchard,¹³ Burrell¹⁴ and others emphasized a long period of rest in bed—several months—even in the most favorable cases. This I heartily endorse, for often the process of absorption of the exudates and granulation tissue is halted by the patient's getting out of bed too early, thus disturbing the powers of resistance. The more scar tissue that remains, the greater is the opportunity for bronchiectasis to develop. Heliotherapy is a great aid as a general tonic. Expectorants are at times helpful in loosening the sputum and preventing the fatigue of unproductive cough. Sedatives should be reserved for use at night as a rule, if necessary to insure rest. They should rarely be given during the day, for they will definitely thwart the purpose of evacuating the abscess. Cardiac stimulants at times are necessary. Because of the spiriochetal group of bacteria, arsphenamine has been used to advantage in selected cases.

12 Miller, J. A. Medical Aspects of the Treatment of Abscess of the Lung, New York State J. Med. **27** 43, 1927

13 Pritchard, J. S. The Value of Rest in Cases of Empyema and Lung Abscess, J. A. M. A. **79** 2208 (Dec. 30) 1922

14 Burrell, L. S., Edwards, A. T., and Martin, G. E. Discussion on Treatment of Chronic Non-Tuberculous Infections of the Lungs, Proc. Roy. Soc. Med. (Sect. Med., Surg. & Laryngol.) **20** 35, 1927

POSTURAL DRAINAGE

Special mention should be made of postural drainage. Experimentation in each case will determine that position which favors expectoration most easily. Some physicians favor gradual raising of the foot of the bed up to 14 or more inches on shock blocks, the patient lying on his stomach. Others hang the patient vertically down from the waist over the side of the bed. This is rather severe treatment for the very sick person. Mandelbaum¹⁵ has devised an apparatus for jack-knifing the patient over a bar, a procedure which favors postural drainage and pressure under the diaphragm. The most successful method is generally the one which the patient will take voluntarily at frequent intervals, and in which he will be most relaxed. In the hospital I have used a padded inclined plane from the side of the bed to the floor, while in the homes an inverted chair tilted up to the bedside is simple and efficient. The patient lies across the bed, bending at the hips onto the inclined plane. Sometimes the knee-chest position is easily carried out.

BRONCHOSCOPY

If postural treatment alone will effect satisfactory drainage of the cavity, the abscess may be expected to heal. This will be evidenced by a fall in temperature, decreased expectoration, increasing strength and roentgen evidence of diminution in the surrounding pneumonia and the size of the cavity. But if the outlet of the cavity into the bronchus becomes blocked by granulation tissue or extremely thick pus and debris it is time to perform bronchoscopy if it can be performed by one well versed in its use. One of the patients in the present series was making good progress when this seemed halted for a couple of days. The temperature rose, and the sputum decreased slightly. The roentgenogram showed the abscess tense with pus. An emergency bronchoscopy was done, the granulations and debris were cleared away, and out rushed the pus which was under some pressure. Convalescence continued favorably. In post-tonsillectomic pulmonary abscesses, bronchoscopy has been used to maintain the patency of the drainage tract when nature could not do it herself. This will be discussed more at length in the papers by Dr. Schall and Dr. Clerf.

This system is given from eight to ten weeks' trial, and is continued if satisfactory progress is made, as evidenced by decreased toxicity, diminished sputum and roentgenologic evidence of improvement. If there is failure to make progress under medical and bronchoscopic treatment in from eight to ten weeks, the time for surgical measures has arrived. The abscess has had time to become walled off, and sur-

¹⁵ Mandelbaum, M. J. Postural Treatment of Lung Suppuration, *Arch. Int. Med.* 40:840 (Dec.) 1927.

gical dangers are much reduced. This period of watchful waiting, even in those cases in which surgical intervention was anticipated because of the duration of the abscess, has placed the patient in a position in which the disease will yield much more readily to operation.

POSTOPERATIVE MANAGEMENT

Prolonged rest in bed is important for the absorption of the exudates and granulations, exactly as in tuberculosis. The sooner the patient gets about, the more fibrosis will develop, leading to bronchiectasis. When the opportune time arrives, foci of infection should be removed to prevent drainage of infected material into the system and perhaps directly into the lungs already rendered more vulnerable. It is a mistake to allow these patients to become obese, for this often predisposes to infections of the respiratory tract. Heliotherapy and massage, together with active motion while in bed will help build a stronger physique. Comparative roentgenograms are the best guide as to the rapidity of healing and consequently as to when the patient should be allowed more freedom.

PREVENTION OF PULMONARY ABSCESS

Appreciating the fact that abscesses occur from both aspirated material and emboli and that preceding disease in the lungs provides a more fertile field for localized trouble, I would suggest the following as possible preventive measures:

(1) Preoperative complete examination of the patient with special reference to his lungs. Operation should be delayed if there are acute infections of the respiratory tract, some of these show no signs in the lungs, the patient complaining only of cough. Chronic or recurring bronchitis should be cleared up as much as possible by rest in bed, etc., before tonsillectomy. In tuberculous patients, a period of rest in bed should precede operation to improve the local as well as the general status, if possible, these patients should be in a stage of improvement when operation is performed. Ether should be avoided chiefly because of its irritative action on the tuberculosis.

(2) Hygiene of the mouth. I favor the extraction of poor teeth and scaling all tartar from those remaining before operation is instituted. Often there is an equal choice as to whether tonsillectomy or dental work should be done first. The foregoing facts suggest the dangers of spirochetes in excess being present in the mouth.

(3) Local anesthesia. For most adults this type of anesthesia has advantages well recognized. Any form of anesthetic used should not be carried to the point of abolishing the swallowing or cough reflex, and should avoid forcing foreign material through the larynx.

(4) Suction apparatus Such apparatus is in practically universal use and of particular benefit if the patient can be in the horizontal position

(5) Avoidance of unnecessary crushing of tissue and mass ligations, which favor the formation of thrombi There is no reason why these thrombi may not contain spirochetes, etc., as well as the aerobes

(6) Care of the mouth immediately after as well as before operation

SUMMARY

Pulmonary abscesses follow, although not frequently, operation on the upper respiratory tract and teeth, and may be produced by aspiration or emboli The anaerobes may be of particular importance in the formation of abscesses in otherwise merely pneumonic processes Physical signs are less helpful than a carefully secured history and a series of roentgenograms in the diagnosis and management of the disease The bronchoscopist and surgeon are most important members of the team, and should frequently be in consultation with the internist Medical treatment offers a much brighter outlook per se and as a preparation for operation than was the case in early surgical procedures Some abscesses may be prevented by thorough examination of the patient, to rule out acute and localized pulmonary disease and by more attention to hygiene of the mouth before and after operation

POSTTONSILLECTOMIC PULMONARY ABSCESS

FACTORS IN HEALING *

EMILE HOLMAN, M D

SAN FRANCISCO

As knowledge in the treatment of patients with intrapulmonary abscess is gained and recorded, it becomes increasingly evident that there are various routes which may be, and which sometimes must be, traversed before ultimate recovery from such an abscess is achieved. The most favorable time for the cure of the abscess is during the period immediately following its inception, and the treatment then will necessarily be different from that attempted at a later stage when the thickened, rigid walls of the abscess present one of the most baffling problems in surgery.

As an illustration of the effect of early treatment properly applied under the cooperative management of physician, bronchoscopist and surgeon, the following case may be cited.

REPORT OF CASES

G B, single, aged 27, an Italian laborer, had an appendectomy under ether anesthesia in November, 1927, with an uneventful convalescence. Two weeks later, a tonsillectomy was performed with the patient under ether anesthesia. Immediately after recovering from the second anesthesia, the patient began to cough. This cough was nonproductive for several days, except for occasional blood-streaked mucus. On about the fifth to the seventh day he began spitting up a thin, greenish, foul-smelling sputum, which gradually increased in quantity. He remained in the hospital for only ten days after the operation, when he was permitted to leave. Since that time he had had a constant productive cough, foul breath, night sweats, loss of appetite and weight, an afternoon fever and pain in the right side of the upper part of the chest (fig 1).

Examination six weeks after the tonsillectomy elsewhere revealed a slight increase in respirations and pulse rate, a definite lagging of inspiratory movements on the right side and slight impairment to percussion anteriorly just below the clavicle, where occasional râles were heard. There was a distinct early clubbing of the fingers. The fever ranged from 37 to 38.4 C (98.6 to 101.1 F), the pulse rate from 80 to 100, and respirations from 20 to 24. The sputum ranged in amount from 250 to 375 cc daily, and the amount was not altered by different postures. During a week's rest in bed, the patient's fever and pulse showed little improvement, and on the eighth day a bronchoscopy was performed. A moderate amount of pus was seen in the main bronchus on the right, and the bronchus to the upper lobe of the right lung was occluded by a pointing projection of granulations. A curved

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† From Stanford University Medical School

* Presented before the American Bronchoscopic Society, San Francisco, July 6, 1929

aspirator was passed into this bronchus, and a "considerable amount" of pus was aspirated. Following this, there was a temporary increase in the amount of sputum from 300 to 375 cc, but on the twelfth day after admission it dropped to 180 cc and on the fourteenth day to 90 cc. A definite improvement in temperature and fall in pulse rate occurred also. Bronchoscopy was again performed on the fourteenth day with aspiration of only a small amount of pus, and on the twenty-first day bronchoscopy failed to obtain any pus. On the twenty-eighth day only the slightest amount of pus was obtained at bronchoscopy, and on the thirty-fifth day only 1 cc was obtained.

The temperature during the past four weeks had been practically normal, and sputum had decreased to about 15 cc daily. There had been an almost complete cessation of cough, a remarkable subjective improvement, with a gain in weight from 145 to 150 pounds (65.8 to 67.9 Kg.).

The changes in the roentgenogram paralleled these clinical improvements. The abscess cavity in the upper lobe of the right lung, which originally measured

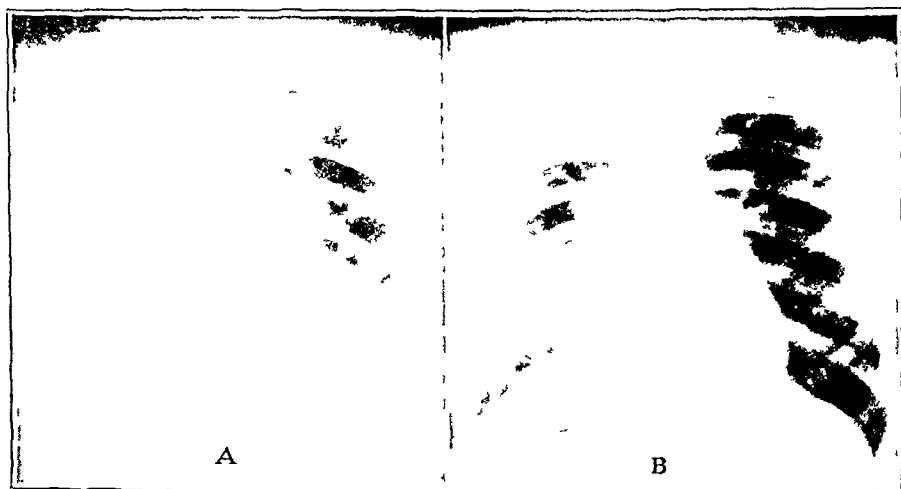


Fig 1—*A*, roentgenogram of abscess in upper lobe of right lung, six weeks after tonsillectomy, *B*, appearance after three weeks' medical treatment of rest in bed and postural and bronchoscopic drainage. Note almost complete disappearance of lesion.

approximately 3 cm in diameter, surrounded by an area of increased density 7 cm in diameter, gradually decreased until the roentgenogram taken on the thirty-fifth day showed only the slightest change, not 1 cm in diameter, with no evidence of a cavity present.

As an example of some of the difficulties encountered in the chronic cases, I may cite the following instance:

A child, aged 8, had had tonsillectomy and circumcision performed under ether anesthesia three years prior to admission to the hospital. He remained in the hospital only one day after the operation, but during the weeks following his discharge, a fever of 105 F developed, with abdominal pain. After six weeks, a diagnosis of pulmonary abscess was made. He was placed in bed in the sun for more than a year, and at the end of this time a severe bronchopneumonia developed, followed by an empyema necessitatis. By resection of the eighth rib, not

only was the empyema drained, but a large intrapulmonary abscess of the lower lobe was also drained. This lasted for about nine weeks, when the chest wound closed spontaneously. During the next two years there was expectoration of much foul sputum, and six months previous to admission signs of an abscess appeared in the upper lobe of the right lung. At the time of admission, the roentgenogram revealed two abscesses in the right lung, one in the upper lobe anteriorly and a large cavity in the lower lobe posteriorly (fig 2). His tempera-

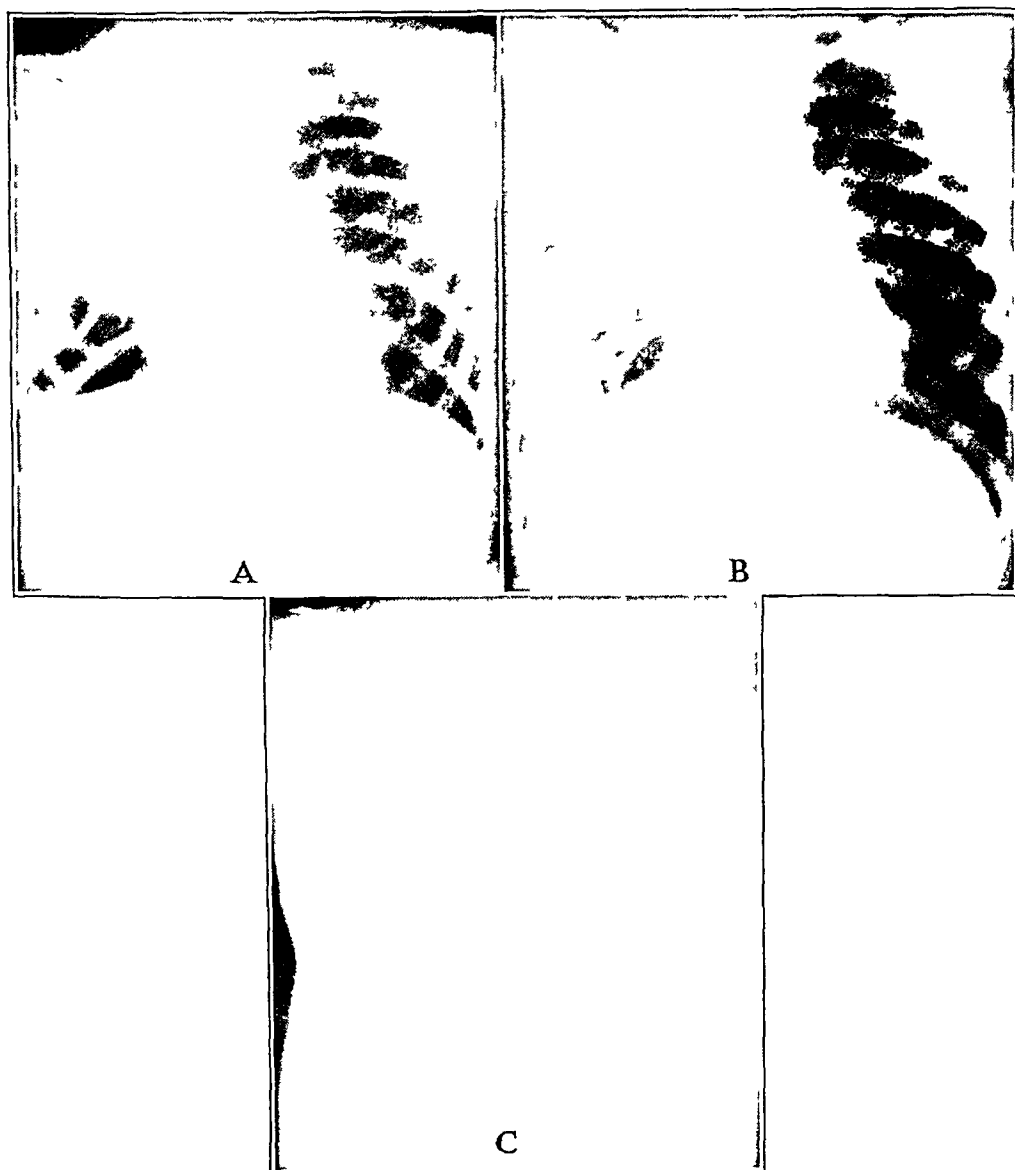


Fig 2—*A*, abscesses in upper and lower lobes following tonsillectomy three years previously. These large cavities with rigid walls can be obliterated only by extensive surgical procedures, *B*, cavities injected with iodized poppyseed oil 40 per cent, and *C*, appearance eight months later following phrenicectomy and multiple operations for resection of ribs.

ture during the first three weeks in the hospital ranged from 100 to 105 F, with a pulse rate of from 110 to 140 and respirations from 24 to 52. On March 1, the eighth rib was resected and the cavity in the lower lobe drained. On March 22, portions of the second and third ribs were removed anteriorly to drain the

abscess in the upper lobe On May 10, the right phrenic nerve was resected to bring about elevation of the diaphragm and to assist in obliterating the cavity in the lower lobe On May 14, a paravertebral thoracoplasty with resection of 8 cm of the seventh, eighth, ninth and tenth ribs was performed, and on May 26, portions of the fifth, sixth and eleventh ribs were removed

On August 13, the posterior abscess was uncovered by resection of the overlying ribs, and a skin flap was introduced into the cavity, leaving a large raw surface for subsequent skin grafting

On November 5, according to the method of Butler, a large skin flap was elevated anteriorly and a large amount of necrotic pulmonary tissue removed with an aspirating tube from the abscess in the anterior part of the upper lobe

In January the third, fourth, fifth and sixth ribs were resected anteriorly, and the middle lobe was exposed It was found to be completely atelectatic with no areas of softening in it This was done to rule out any suppurative process in the middle lobe, the exact condition of which had been unknown

The child is progressing favorably with two bronchial fistulas, but sufficient collapse of the abscess cavities will probably not be effected until a complete thoracoplasty is performed on this side

It is an axiom that an understanding of the physiologic processes underlying repair, as well as a consideration of the factors underlying the development of an intrapulmonary abscess, provides important foundations for the logic of certain therapeutic measures

As to the development of an abscess, it may be stated that an intrapulmonary abscess is produced by the destruction and liquefaction of pulmonary tissue through the action of infecting organisms These organisms may reach the lung by way of the bronchi or by way of the blood stream If by the latter route, the offending embolus may be infected by one or more organisms It is probable that the prompt healing of certain postoperative abscesses following a single effective evacuation into a bronchus may be explained on the basis of a blood-borne infection with one organism, and that this group provides the most favorable cases for medical care supplemented by one or two bronchoscopic treatments It is true that such abscesses usually become secondarily infected once they have burst into a bronchus, but there is already a protective reaction present which may limit the process and prevent a more widespread destruction of pulmonary tissue Van Allen¹ has shown that abscesses of the lung produced by *Staphylococcus aureus*, which are known to heal promptly and usually spontaneously, can be changed into a more chronic lesion by infecting the abscess secondarily with oral organisms by way of the bronchus The difficulty of cure is correspondingly enhanced

The second group of abscesses, a group in which surgeons are prone to include most of the postoperative abscesses, is the result of

1 Van Allen, C M, Adams, W E, and Hrdina, L S Bronchogenic Contamination in Embolic Abscess of the Lungs, Tr Am A Thor Surg **19** 1262 (Dec) 1929

bronchogenic infection, these abscesses are usually due to the many organisms found in the mouth and pharynx and more particularly around carious and infected teeth. These organisms include the anaerobic and putrefactive bacteria, the streptococcal group, the vibrios, the spirochetes, *Bacillus fusiformis* and, as recently emphasized by Varney² of St. Louis, *Bacillus melaninogenicum*. Such abscesses are of much more serious import, because of the widespread destruction of pulmonary tissue, because of the multiplicity of organisms producing the inflammation and because of the varying degrees of virulence displayed by these organisms. The extent and spread of an inflammatory process may be determined by the extent of the thrombosis of the vessels leading to and from the site of inflammation, and it is probable that with a multiplicity of organisms present, there is a more extensive thrombosis of both pulmonary and bronchial vessels with consequently greater destruction of tissue. Such abscesses will not yield so promptly to simple treatment, and they are prone to develop into more chronic lesions.

Not only may intrapulmonary suppuration be produced by the aspiration of infected material and by infected emboli, but recent experiments³ have shown that sterile emboli liberated in the blood stream may become secondarily infected from a coexisting or subsequent bacteremia, and that the previously sterile embolic area breaks down with the formation of typical abscesses.

The following experiments may be cited:

ANIMAL K26—The animal was killed fifteen days after the introduction of one infected and one sterile embolus into the jugular vein. The infected embolus lodged in the lower lobe of the left lung and produced numerous abscesses in the pulmonary tissue beyond it. The sterile embolus lodged in the lower lobe of the right lung, and the embolic area beyond it likewise showed multiple abscesses.

ANIMAL K59—On February 25, an experimental cholecystectomy was performed following which the abdominal wound became infected. Only a draining sinus remained on March 13, when an exploratory laparotomy was performed by students. Again the wound became infected.

Twenty-eight days later, in the presence of two abdominal wounds draining a small amount of pus, two sterile emboli were introduced into the jugular vein. Pus continued to drain from the wounds until the animal was killed twenty-two days later. At necropsy in the deflated state, there was a small scar on the pleura of the lower lobe of the left lung underneath which a round, firm area, 1.5 cm in diameter, could be felt. In the same lobe, a second smaller rounded firm area could be felt. After inflation, the lung appeared remarkably different (fig 3). There was marked retraction of the lower lobe of the left lung with marked

2 Varney, Philip. Bacteria in Pulmonary Suppuration, Tr. Am. A. Thor. Surg., to be published.

3 Holman, E., and Mathes, M. E. The Production of Intrapulmonary Suppuration by Secondary Infection of a Sterile Embolic Area. An Experimental Study, Tr. Am. A. Thor. Surg. 19: 1246 (Dec.) 1929.

diminution in its volume. It is evident that the true pathologic state of a lung cannot be determined by examination of the deflated lung only.

A roentgenogram showed both emboli in the lower lobe of the left lung with marked reaction about one of them. The bronchial artery leading to both emboli was markedly dilated, and the pulmonary artery beyond the emboli was not filled except for a slight injection in the region of the abscess through the bronchial artery.

The cut section revealed a small, irregular abscess cavity in which lay an embolus. Surrounding the cavity and extending to the visible depressed scar on the surface was a well defined area of consolidation. The second embolus was



Fig. 3—Marked retraction of lower lobe of left lung containing an abscess produced beyond a sterile embolus introduced into the jugular vein in the presence of suppurating abdominal wounds.

encapsulated by fibrous tissue, but otherwise there was no pathologic change in the pulmonary tissue around it.

ANIMAL R49—This animal was received by the laboratory with a compound suppurating fracture of the left hind leg. Aside from the open wound of the leg, the dog seemed well. On March 7, two sterile emboli were introduced into the jugular vein. The dog was killed eight days later, and at necropsy, there was noted on the surface of the upper lobe of the left lung a deep red, softened area about 2 cm. in diameter. The second embolic area was not visible until the

lung was inflated, when it was disclosed in the lower lobe of the right lung by its paler color. The branches of the bronchial artery leading to the lobes containing the emboli were greatly dilated, and there was no filling of the pulmonary artery beyond either embolus (fig 4).

The cut section of the upper lobe of the left lung showed an abscess cavity, 1.5 cm in diameter, with a fairly thick wall surrounded by a limited pneumonitis. There was no pathologic change around the second embolus.

Whatever may be the origin of the infecting organism, whether by way of the blood stream or by the bronchi, the resulting destruction of pulmonary tissue leaves a dead space—the abscess cavity—which must

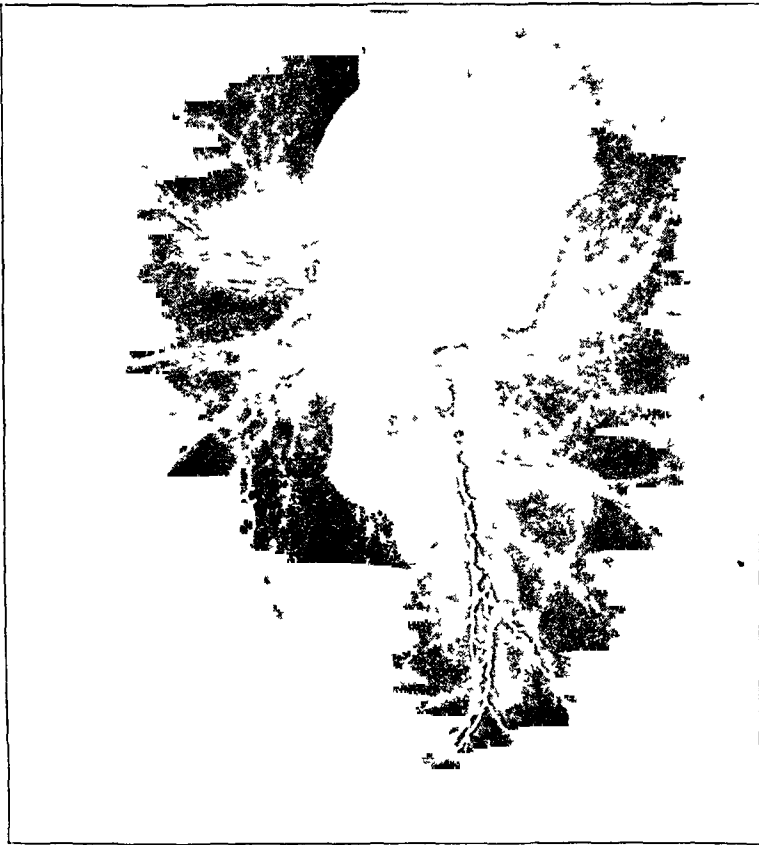


Fig 4—Pulmonary abscess surrounding a sterile embolus introduced into the jugular vein in the presence of a suppurating compound fracture of the leg.

be obliterated. The three important factors in the obliteration of the abscess cavity are (1) adequate drainage, (2) the gradual contraction of fibrous tissue laid down as granulations in the wall forming the abscess and (3) the expansion of the healthy normal lung to replace the destroyed lung. Under certain conditions, the expansion of the lung to fill potential spaces in the thoracic cage is almost unbelievable. Working in the Hunterian Laboratory some years ago, I removed in three successive stages the entire lung on one side and one of the three lobes on the other side. The chest was filled by the remaining two lobes of the lung, and the animal led a perfectly normal existence.

This normal potential expansion of a lung is a most important factor in the obliteration of an abscess, but it may be greatly limited by several adverse conditions. Late recognition of the abscess and inadequate treatment resulting in a prolonged and chronic course may cause the deposition of so much fibrous tissue in the wall of the abscess that it becomes rigid and incompressible so far as the expansile force of the normal lung surrounding it is concerned. A cure under such circumstances is accomplished only by compression of the external wall of the chest through the extensive removal of ribs.

A second condition adverse to the expansion of the lung is an imperfectly drained abscess through a small bronchus or a constricted bronchus. When an abscess has a large, free opening into a bronchus but no external opening, the factors determining the expansion and distention of the lung operate as under normal conditions, and there is a constant tendency for the normally expanding lung to obliterate the cavity. The explanation probably lies in the fact that the normal lung is capable of much greater expansion than is affected by normal inspiration, but is limited in its expansion by the thoracic cage which it normally fills completely even in expiration. Because of this restricting action of the wall of the chest, the expanding lung in inspiration would have a tendency to obliterate any thin-walled cavity within it.

If, however, the abscess cavity cannot be easily emptied, owing to the small size of the opening into the bronchus, or if there is a constriction in the bronchus which is slightly open in inspiration only and closes down in expiration so that the contained pus and air are unable to escape when the wall of the chest is temporarily compressed, a situation exists in which during part of the respiratory cycle the pressure within the cavity exceeds the pressure without. The tendency to collapse during inspiration is counterbalanced by the tendency to expand during expiration, and the cavity is likely to remain stationary in size or even to grow larger.

Under such conditions, it is most necessary either to establish a free opening between the bronchus and the abscess cavity or to provide external drainage. The bronchoscopist may achieve it by the removal of granulation tissue, by the dilatation of a cicatrized bronchus and by the complete emptying of the cavity through suction so as to turn the tables in favor of the chief obliterating agent—the normal expanding force of the lung.

The most important factor, therefore, in the cure of an abscess is adequate drainage. If this is impossible through a bronchus drainage through an opening in the wall of the chest is indicated. There are several reasons, however, why one should try to avoid external drainage, giving the bronchoscopist every opportunity before resorting to it. Pus and bronchial secretions which may continue to accumulate in the

bronchi around the abscess must be coughed up, but the expiratory effort necessary in effective coughing is rendered almost impossible by a large through-and-through passage produced by an external opening.

Other difficulties of healing arise in the presence of a large bronchial opening through the wall of the chest. The normal expanding power of the lobe containing the abscess is effectively reduced by the external opening. The marked reduction in vital capacity produced by a large bronchial fistula is indicative of the lessened expanding power of the lung. This point was recently illustrated in a patient who had worn a rubber tube in her side for eighteen months as a drain for a pulmonary abscess. When the lobe was removed subsequently, it was found almost completely shrunken and atelectatic through failure of alveolar exchange during the many months of the bronchial fistula. An external fistula in conjunction with an internal fistula, therefore, is an adverse factor to the obliteration of the abscess cavity by eliminating or reducing the expanding power of the normal lung surrounding the cavity. Every effort should be made to secure complete and adequate drainage of the abscess through the bronchus before introducing the embarrassment and impairment of normal alveolar exchange by an external fistula.

External drainage, of course, is mandatory when no opening or only a small opening into a bronchus exists. Under these circumstances, healing should be rapid since the normal expanding power of the intact pulmonary tissue is no more affected than when the abscess is drained through a large opening into a bronchus, and one may expect the same processes of fibrous contraction and expansion of pulmonary tissue to obliterate the cavity without great delay.

Recent experimental studies indicate that one of the important favorable factors in the healing of an abscess or suppurative condition within the lung is the double vascular supply consisting of the pulmonary artery and vein and the bronchial artery and vein. The latter artery branches from the intercostal arteries and carries, therefore, a systemic blood pressure as contrasted with the much lower blood pressure in the pulmonary system. According to Miller,⁴ the bronchial artery supplies all the pulmonary tissue, including the alveolar septa, the bronchi and even the vasa vasorum of the pulmonary artery.

In connection with the experimental production of pulmonary abscesses by infected jugular emboli, it was found that the development of the abscess was accompanied by a remarkable dilatation of the bronchial artery leading to the lobe containing the infected embolus and the subsequent abscess.³ This dilatation though to much less marked

⁴ Miller, W. S. The Arrangement of the Bronchial Vessels, *Anat. Anz.* 28:432, 1906.

degree, occurred also in the bronchial artery leading to lobes containing sterile emboli. The dilatation was apparently greatly influenced by infection, and it is probably of considerable importance in limiting the extent of the infection and in promoting the healing process that follows (fig 5). The remarkable recuperative powers of the lung in the face of widespread infection may be partly the result of this dual blood supply, and particularly the result of the dilatation of the bronchial artery leading to the site of infection.

It is obvious that if for some reason the infecting organisms should lodge in the bronchial artery or should produce a thrombosis of the bronchial artery as it lies in such close contact with the bronchus, there might occur destruction of pulmonary tissue of much greater extent than in the presence of an intact bronchial artery.

A most important deterrent to recovery and healing of intrapulmonary suppuration is the coexistence of a systemic disorder such as diabetes or renal incompetence. In the presence of diabetes the suppurative process in the lung behaves no differently than does a carbuncle elsewhere under similar circumstance, and even with the use of insulin the extension and progress of the inflammatory process is difficult and often impossible to control.

With reference to the actual surgical measures to be undertaken (only after adequate medical and bronchoscopic measures have failed), certain points need to be mentioned as of particular importance.

Accurate localization of the abscess by stereoscopic and lateral roentgen examination is imperative.

The needling of a probable intrapulmonary abscess without direct visualization of the abscess by resection of ribs is absolutely contraindicated. The danger of pleural infection in the absence of adhesions between parietal and visceral pleurae is obvious, and yet I recently saw in a prominent clinic the death of a patient who succumbed to a massive empyema following the intercostal aspiration of an intrapulmonary abscess.

If parietal and visceral pleurae are not adherent at the time the rib is resected, the wound must be packed with gauze approximating the two pleurae by pressure. Several days later the abscess may be opened by incising the pulmonary tissue with a black, not red cautery, so as to char the tissue slowly and seal the pulmonary veins against a possible fatal embolism of air or pus.

The number of ribs to be resected should be sufficient to permit rather extensive cauterization of the involved pulmonary tissue, a measure to be undertaken if necessary in two or more sittings. Care is necessary to avoid getting beyond the adherence of visceral and parietal pleurae, but wide cauterization is important in securing adequate

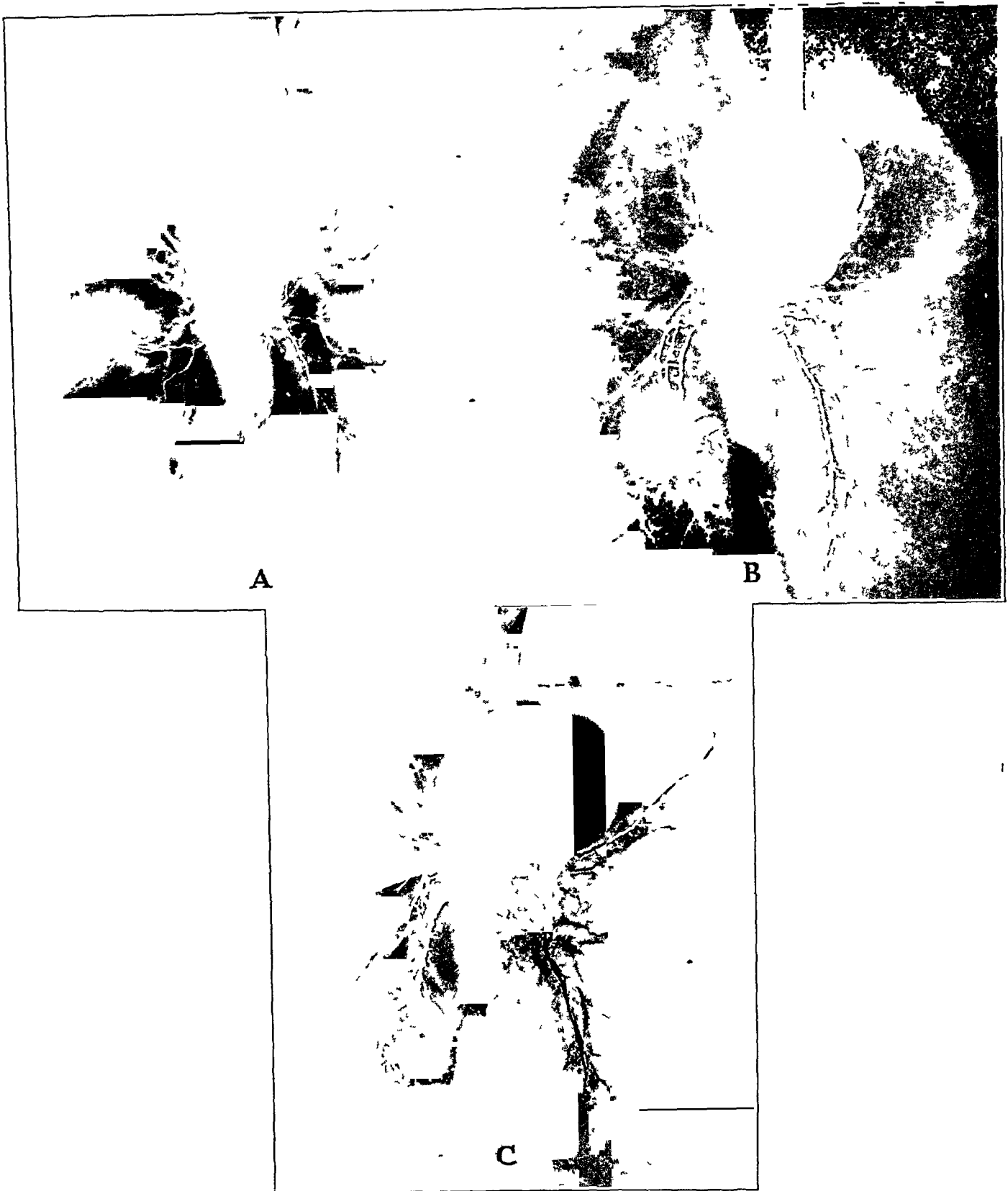


Fig 5—Injection of bronchial artery in presence of embolic pulmonary abscesses. *A*, four days after introduction of infected embolus, *B*, eight days after introduction of infected embolus, and *C*, thirty-one days after introduction of infected embolus, showing the marked dilatation of bronchial artery to lobe containing the abscess. The increased blood supply through the bronchial artery is undoubtedly an important factor in healing.

and sufficiently complete drainage of all the pockets of pus surrounding the main abscess

The use of heavy rubber tubing as a means of drainage is absolutely contraindicated because of danger of injury to pulmonary tissue by contact with a hard inflexible object. Fatal hemorrhages and cerebral emboli have resulted from the use of rigid tubes for drainage. Instead the cavity is well packed with either gauze smeared with petrolatum or acriflavine gauze to serve as a bulwark against which the lung may find support during the expiratory effort of coughing. This is most

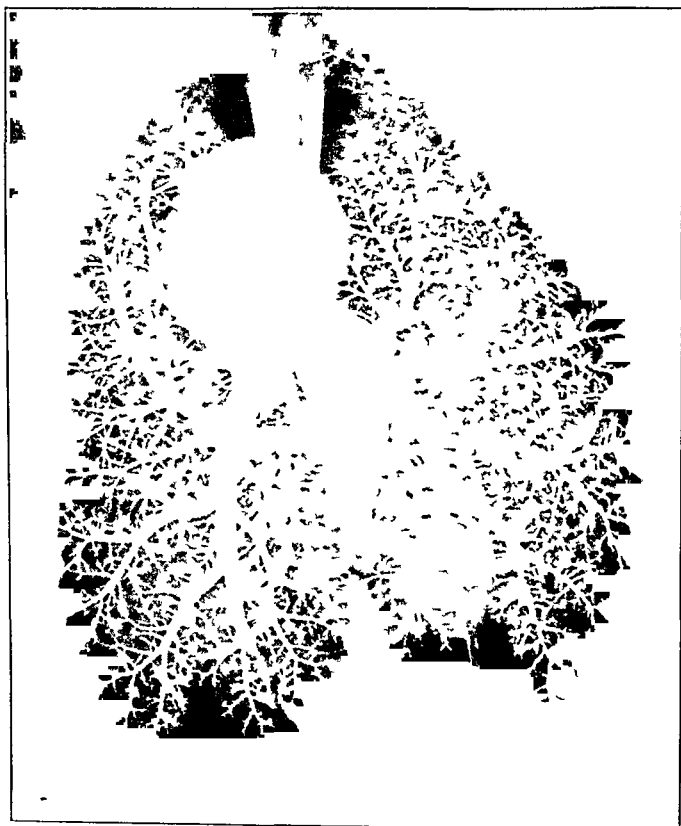


Fig 6—Injection of pulmonary artery in presence of an embolic pulmonary abscess showing complete cutting off of pulmonary artery beyond the embolus (Same specimen as *B* in figure 5)

important in the immediate postoperative period in order to avoid bronchogenic spread of the infection through the accumulation of pus in the bronchi surrounding the abscess

Drainage should be accompanied also by absolute rest in bed, and by the usual supportive measures, until all evidence of the abscess, clinically and roentgenologically, has disappeared

The residual bronchial fistulas may gradually close spontaneously, although healing may be accelerated by the repeated injections at

intervals of two or four days of a bismuth paste composed of 30 per cent bismuth subcarbonate in petrolatum. A large fistula which shows little sign of closing must be treated by mobilization of the surrounding pulmonary and fibrous tissue, by inversion of the bronchial opening, and by the resection of additional ribs overlying the cavity.

Large chronic abscesses with rigid noncompressible walls will require more extensive operations such as phrenicotomy, partial or even complete paravertebral thoracoplasty, on occasion, lobectomy may provide the only recourse when an entire lobe is riddled with multilocular abscesses. The method of choice in performing lobectomy is probably a combination of Archibald's principle of collapsing the wall of the chest so as to approximate the hilus and the chest wall and Whittemore's method of exteriorization of the lobe, with subsequent removal by repeated cauterization.

PULMONARY ABSCESS FOLLOWING TONSILLECTOMY

BRONCHOSCOPIC CONSIDERATIONS AS AN AID TO THE SURGEON¹

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To be of aid to the thoracic surgeon the bronchoscopist must appreciate his problems and understand somewhat the principles of his surgery. I assume that today no thoracic surgeon works alone. I assume also that if he has not accepted Jackson's¹ plea for teamwork, he has paid heed to Willy Meyer's² endorsement.

Let all remember that the best results with the least mortality can be obtained by teamwork only, that is, if bacteriologist, internist and surgeon, roentgenologist and bronchoscopist cooperate, often for weeks and months, for the welfare of the patient.

Therefore, when surgical intervention is indicated, the patient has had the benefit of all the accepted conservative methods of therapy. His treatment has been medicinal, climatic, dietetic and drainage—both postural and bronchoscopic—without improvement. Too often the patient seeks the surgeon as a last resort.

The first problem of the thoracic surgeon, then, is the location of the abscess, for location often determines the type of operation. He must know not only the lobe involved, but the location of the abscess within the lobe. He must know its relation to the pleura or to the lung root, its size, its shape and whether he has to deal with a single cavity or multiple abscesses, for he knows that abscesses of long duration are apt to be multiple.

It is essential to remember that every abscess of the lung, before it can be definitely diagnosed as an abscess, either roentgenologically or by physical signs, must have evacuated some of its contents, permitting some air to enter the cavity. It communicates, therefore, with the tracheobronchial tree. This communication may be circuitous, it may be imperfect, but it exists.

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¹ Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, July 6, 1929.

¹ Jackson, Chevalier, Tucker, Gabriel, Clerf, Louis H., Lukens, Robert M., and Moore, William F. *Bronchoscope as an Aid to the Thoracic Surgeon*, J. A. M. A. **84**: 97 (Jan. 10) 1925.

² Meyer, Willy. *Suppuration of the Lung—Surgical Aspect*, Arch. Otolaryng. **7**: 107 (Feb.) 1928.

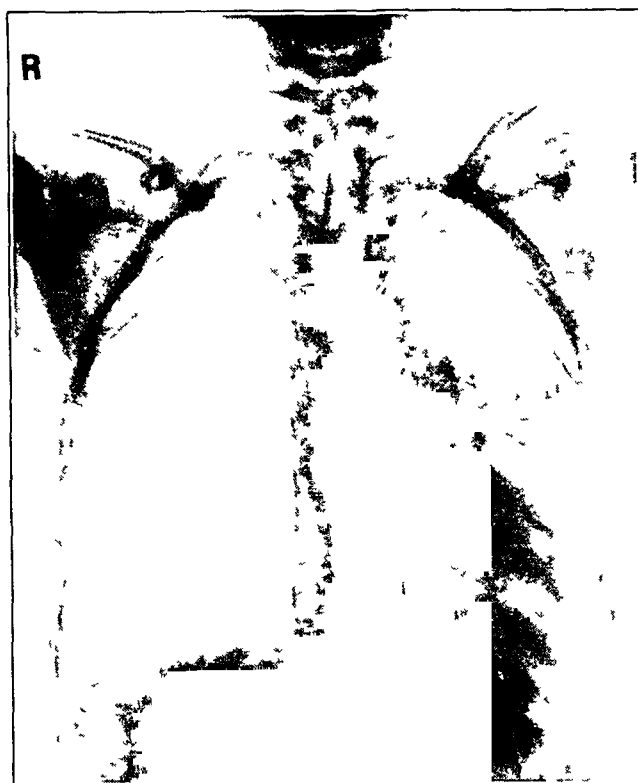


Fig 1—Y V, aged 9 pulmonary abscess of the left lower lobe, following tonsillectomy The bronchus was narrowed by granulations and after two bronchoscopies the bronchus was dilated sufficiently to obtain a pneumogram showing the abscess Notice the fluid level

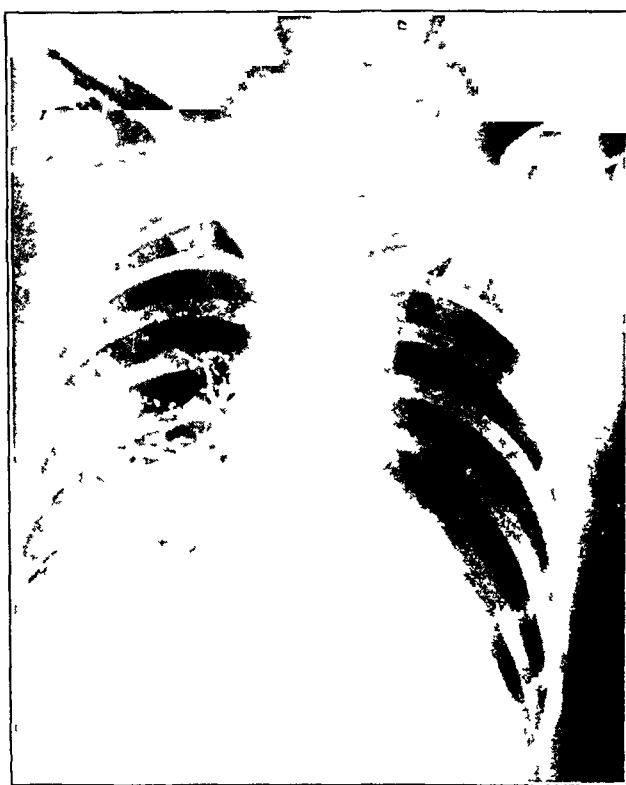


Fig 2—M L, aged 35 pulmonary abscess of the right middle lobe following tonsillectomy The abscess was not reached by the iodized oil, due to bronchial obstruction



Fig 3—F D, aged 36 pulmonary abscess of the right upper lobe Normal lung is outlined, the iodized oil not reaching the abscess



Fig 4—J G, aged 10 pulmonary abscess of the left upper lobe following tonsillectomy Normal lung around the abscess is outlined by pneumography After an apicolysis there was a good recovery

The bronchoscopist can aid in localization (1) by following the pus stream to its source, and (2) by pneumography. The difficulty in demonstrating abscess of the lung by pneumography is appreciated. Several years ago, Smyth and I³ called attention to the error of interpreting "drowned lung" as abscess. To avoid this error, a fluid level or a "diagnosis by exclusion," that is, by outlining normal lung around the abscess, is demanded.

Of all the surgical procedures for abscess of the lung, improvement or cure depends on but two factors: drainage or massive removal. The success of collapsing operations, such as apicolysis, artificial pneumothorax and thoracoplasty, depends on the ability of the abscess to evacuate by way of the tracheobronchial tree. Of thoracotomy, Whittemore⁴ said:

This operation merely changes the direction of the drainage, and where the patient has been raising large quantities of pus by coughing, following the operation large quantities come through the drainage tube and will continue to do so as long as there is an open sinus.

Drainage is essential, and the bronchoscopist is justified in saying that he can aid the thoracic surgeon by securing the maximum bronchial drainage of the involved area. Drainage can be improved by the bronchoscopic removal of thick tenacious secretion, by the dilation of any stricture or strictures that may exist and by the removal of any granulation tissue that is tending to obstruct the bronchus.

In certain cases, the bronchoscopist can aid the surgeon by finding the abscess with the bronchoscope, and, by leaving it in situ, permit the surgeon to open the abscess by cutting down on the bronchoscope. Both Clerf⁵ and Kernan⁶ reported having rendered this aid to the surgeon.

CONCLUSIONS

1. The bronchoscopist is of aid to the thoracic surgeon in localization of the abscess (1) by following the pus stream to its source and (2) by pneumography.

2. The bronchoscopist can improve drainage by the dilation of strictures and by the removal of granulation tissue that may be obstructing the bronchus.

3. In certain cases, bronchoscopic sounding permits the surgeon to open the abscess by cutting down on the bronchoscope.

3 Smyth, D. C., and Schall, L. A. Pneumography by Lipiodol. Its Present Uses and Limitations, *Ann. Otol., Rhin. & Laryng.* **36**: 1134 (Dec.) 1927.

4 Whittemore, Wyman. The Treatment of Chronic Broncho-Pulmonary Suppurative Lesions Limited to One Lobe of the Lung, *New England J. Med.* **199**: 1213 (Dec. 13) 1928.

5 Shallow, Thomas, and Clerf, L. H. *Proc. Philadelphia Acad. Surg.*, 1924.

6 Kernan, Jr., John. *Tr. Am. Bronchoscopic Soc.*, 1927, p. 133.

EXTERNAL OPERATION ON THE FRONTAL SINUS

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I present this small series of twelve cases because there is no operation in the domain of rhinology around which so much controversy has raged as the external operation on the frontal sinus. There is no operation which has been productive of so much disappointment and discouragement, no operation which has been fraught with so much repulsive physical deformity. It is also attended with great danger to life. The value of this operation is still in the balance, and therefore I feel that every time it is performed the results should be reported in careful detail. The apparent successes, the discouraging failures, the sad fatalities should be brought to light so that discriminating men may carefully piece together a complete technic which will give at once the safest and most efficient method of attack on chronic empyema of the frontal sinus.

In the cases presented here, with one exception, the operation was performed by the same method. It is known in the literature as the Jansen-Ritter, the Knapp and the Lynch method. While I hold no brief for Dr. Lynch, and while he says himself that his operative technic is not original, but is made up of bits of technic adapted from the work of various men, the fact remains that Dr. Lynch set out clearly each step of his technic and advanced sound and convincing reasons for each procedure, so that it is easy to follow him and get the same results.

There are those who can recall with what enthusiasm the first reports of Killian's operation were received, and as he continued to report successes how the enthusiasm grew. When he was the honored guest of the section at Atlantic City in 1907, he was hailed as a conqueror. I will never forget seeing the old man on the board-walk returning from a banquet, wearing a chaplet of leaves on his head and sitting on top of the world! In Philadelphia he demonstrated his operation on the cadaver before several hundred enthusiastic rhinologists. As to the cosmetic effects of his operation, he was not so sure. In answer to a question, he shrugged his shoulders and said, "Eet is not ze operation for ze young ladies!" He swept along with success and growing con-

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fidence through eighty-five operations and then came three fatalities in succession. Reports of recurrences followed. The cases of resulting deformity were disturbing. Also, the relatively large number of fatalities in the hands of other men made one pause. Then came the discouraging conclusion that the Killian operation had not solved the problem. Where are now the operators who were once so enthusiastic over the Killian operation? Few reports are seen of operations done after the Killian method. What then has been learned from the vast experience of the ablest surgeons who have sought to solve this problem? For one thing a hydra-headed monster is being dealt with whose resourcefulness taxes the best skill. When one thinks that he is killed, one finds that he is only scotched, and that he raises his grisly head elsewhere.

It may be of interest to trace briefly down to the present day the course of operative procedure adopted by surgeons. In the beginning there were no rhinologists, and the anatomy of the paranasal sinuses was poorly understood. The general surgeon thought only of drainage, and that externally. In the successful cases, the cavity was trephined and packed for months perhaps until the cavity was obliterated by granulation. Some of the bright surgeons attempted to divert the drainage into the nose by passing a probe through the nasofrontal duct or by breaking away part of the medial and inferior wall. Sometimes drains were introduced, irrigations were practiced together with the use of cauterizing medicaments. However, the frontal sinus was not touched except in case of manifest empyema, such as tumors, fistulas, abscess, etc. All those cases of empyema were ignored which were not manifested by external symptoms. As late as 1887 at the Berlin Medical Congress it was agreed that the frontal sinus should not be opened except in the presence of rupture, pressure on the bulb or intracranial symptoms. It was increasingly noted that the simple trephine operation resulted in few permanent cures. If the mucous membrane had become permanently diseased, recurrence followed with abscess and fistula formation. It then began to be advocated that the diseased mucous membrane should be curetted out. In 1885, Ogston¹ advanced his method which was afterward supplemented by Luc. The method consisted of an incision along the orbital edge and downward toward the root of the nose. The frontal sinus was opened to the outside of the median line, the size of the opening being proportional to the size of the cavity. Curettage of the cavity was performed and the anterior ethmoid cells were broken down and free communication established between the sinus and the nasal cavity. A drainage tube was introduced from the

¹ Ogston. Brit. M. J. May 23, 1885.

floor of the frontal sinus into the nose, and the external wound closed at once. Luc later used iodoform gauze for drainage material.

In 1890, Nebinger² published an article on the operative handling of frontal sinus disease in which practically the same operative technic was advocated except that drainage was provided for externally at the angle formed by the horizontal and vertical incision.

By this time surgeons appreciated the necessity of removal of diseased mucous membrane and the desirability of intranasal drainage. They had not yet given consideration to the cosmetic effect. They were working for a cure and appearances were secondary. The method of Kuhnt,³ reported in 1895, was the most radical of all. According to his technic a horizontal incision along the supra-orbital margin is joined



Fig 1—R. H. O., operated on May 19, 1924. The patient had pansinusitis. All other sinuses were opened and drained previous to the external operation. The frontal sinuses were very large, extending to external angles on each side and up to the hair line. The left frontal sinus drained into the right through a fistulous opening in the interfrontal septum discovered at operation. The interfrontal septum was removed and both frontals were curetted through the operative opening in the floor of the right frontal sinus.

The photograph of the patient was made in 1929. There was no pus or crusting in the nostrils.

by a vertical incision at the inner angle of the eyebrow. The entire anterior wall of the frontal sinus is removed and the contents thoroughly curetted out. When any involvement of the floor of the sinus was present, the floor was also removed. This is the first reference to the removal of the floor of the sinus. On account of its radical procedure, cure was obtained in many cases by complete obliteration of the sinus.

² Nebinger. Dissertation, Erlangen, 1890.

³ Kuhnt. Weisbaden, 1895.

Its weak points were the ignoring of the diseased ethmoid cells, the long period required for healing and the resulting deformity. Luc⁴ frequently operated according to this method by adding to it curettage of the ethmoid cells and enlargement of the nasofrontal duct. Leimoyez also operated in a similar way. In 1894, Jansen⁵ took the first step toward cosmetic effect by preserving the anterior wall of the sinus and removing the floor. This method also was a great advantage in curetting the ethmoid cells. This was, however, not a hard and fast rule with Jansen as he sometimes removed the entire anterior wall when he found it diseased. In 1906, Ritter⁶ modified Jansen's method by removing a portion of the anterior wall in order to be able to inspect the cavity more advantageously.

Riedel,⁷ in 1898, advocated the most radical of all procedures by removing the entire anterior wall, the floor of the sinus and the ascending process of the anterior maxilla together with the removal of the anterior ethmoid cells. Hajek said that this is the most likely of all operations to effect a cure, but that the horrible deformity resulting is the serious drawback.

This review of operative technic brings one again to the period of Killian⁸. Surgeons now recognized that it was necessary to destroy all diseased mucous membrane and to deal radically with bone involvement, and that it was necessary to have a wide opening into the nose. To this end the anterior ethmoid cells were removed, the nasofrontal duct enlarged and as large an opening as possible secured into the nose. To this end also the entire anterior wall of the frontal sinus, the entire floor of the frontal sinus, together with the ascending process of the superior maxilla, were removed. This attack is typified in the operation of Riedel, and is the most radical of all operations on the frontal sinus. It gives the best possible access to all the recesses of the frontal sinus, and if the diseased mucous membrane and diseased bone is not eradicated it is the fault of the operator's technic and not of the operation. What was it then that was detrimental in this operation? It was, of course, the hideous deformity. In view of this, Killian came forward with an operation designed to secure all these benefits without the resulting deformity. In the *Archives für Laryngologie und Rhinologie* 1902, he described his operation.

The Killian operation calls for the entire removal of the anterior and inferior wall of the frontal sinus. His attempt to avoid disfigurement is by the retention of the orbital ridge. The frontal process of

4 Luc Arch internat de laryngol otol rhinol, no 27

5 Jansen, B Arch f Laryngol u Rhinol, 1894, vol 2

6 Ritter Monatschr f Ohrenh, 1906

7 Riedel Dissertation, Jena, 1898

8 Killian Arch f Laryngol u Rhinol, 1902, vol 13

the superior maxilla is resected as in the Riedel operation, thereby giving wide access to the diseased ethmoid cells. A wide communication is assured between the frontal sinus and the nose. The steps of the operation are in a curvilinear incision extending from the outer border of the sinus, as disclosed by a roentgenogram, through the eyebrow down the side of the nose to about the level of the lower bony border of the orbit. Hemorrhage is controlled by hemostats left on until the operation is finished. No ligatures are applied for fear of getting catgut infection. The periosteum is elevated above the incision to correspond to the size of the anterior wall of the sinus. The sinus is opened at its lower anterior border and the whole anterior wall is removed. The diseased mucous membrane is thoroughly removed with a sharp curet. This constitutes the first step of the operation. The second step is the



Fig 2—Miss C. W., operated on Jan. 6, 1925, for closed empyema. The photograph was made in 1929. No pus or crusting was noted in the nostrils.

formation of the bridge. The soft parts are elevated over the orbital ridge, but the periosteum is left so that necrosis of the ridge may not follow. An incision is then made through the periosteum along the lower border of the orbital ridge outlining the bridge. This incision extends along the lower border of the ridge until it joins the first incision. The soft parts and periosteum are elevated over the frontal process and toward the inner and upper wall of the orbit to the insertion of the trochlear. Killian was very insistent on not separating the tendinous attachment of the muscle for fear of causing diplopia. The orbital roof is then carefully removed, caution being necessary to avoid injury to the orbital contents and the brain.

The next step is the removal of the ascending process of the superior maxilla. This gives access to the ethmoid cells which may be curetted easily from this exposure. After removal of the ethmoid cells, the

sphenoid may be curetted. After this stage, Killian constructed a mucous membrane flap from the nasal mucous membrane. This was difficult and time-consuming, and it has been shown that it is of no particular benefit. The next step is the introduction of a thick drainage tube down into the nose and a smaller one externally in the lateral end of the wound. The external tube is removed in two or three days, and

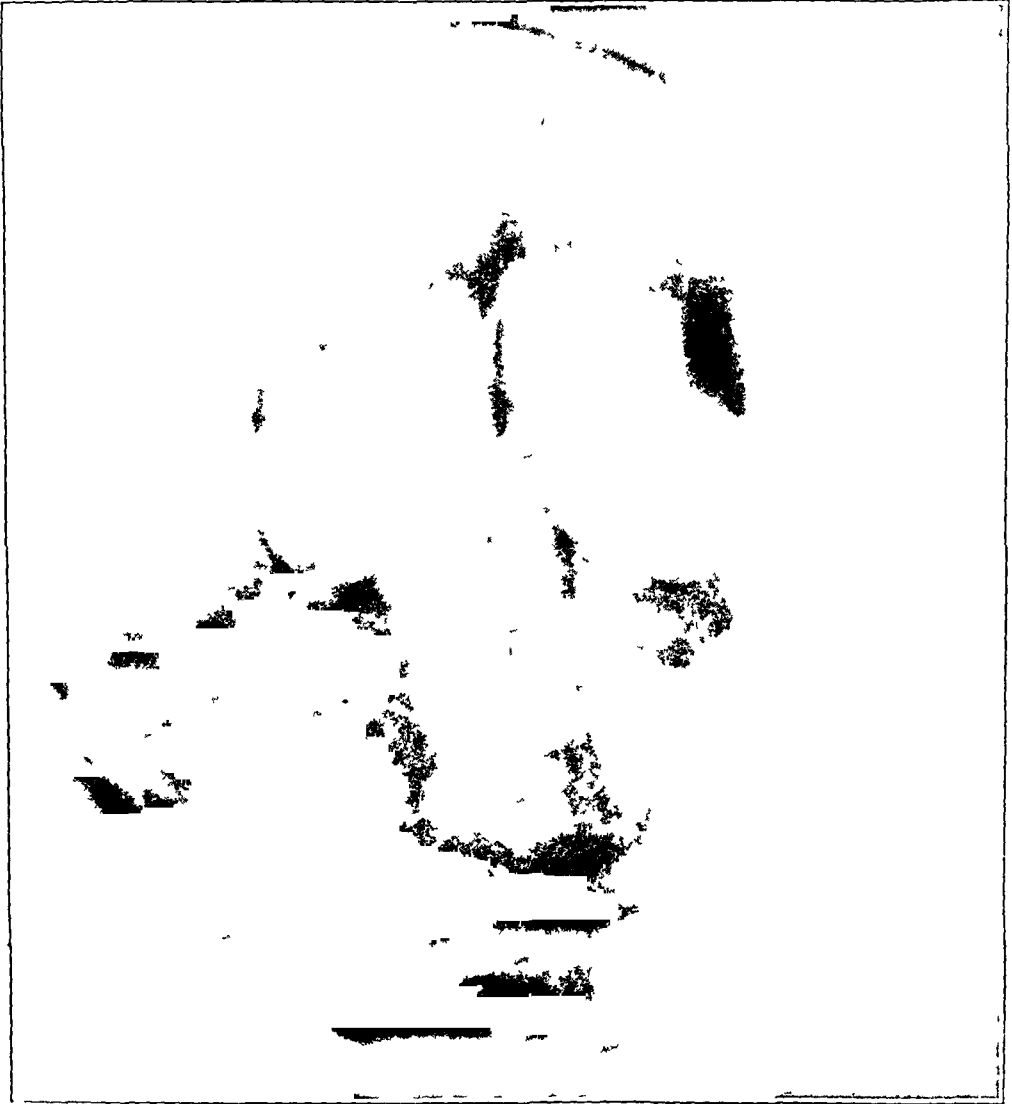


Fig. 3—The greater part of the floor of the left frontal sinus was destroyed by necrosis. Necrosis of the posterior wall exposed an area of the dura as large as a twenty-five cent piece.

the inner one in about eight days. The wound is covered with a light compression bandage.

In 1899, Knapp⁹ described an operation and published the report of a case. The essential features of his operative technic consisted in the preservation of the anterior wall, the removal of the floor of the

⁹ Knapp, A. Arch. Ophth. 18:50, 1899.

sinus and the total removal of the ethmoid cells. He gives credit for his technic to Jansen.

The operation of Lothrop had quite a vogue for a time and is still practiced by a number of men. No doubt many patients have been cured by the use of his technic, but I confess that I am deterred from using it by my hesitation about opening up a perfectly healthy sinus. His theory that epithelialization will take place from the healthy sinus into the operative one is to my mind wholly unnecessary. A frontal sinus on which operation has been performed and which has had all its mucous membrane curetted out, does not heal by epithelialization, but fills with organized granulation tissue.

I have gone over the ground covered by surgeons in their efforts to effect a cure of this disease. As far back as the time of Riedel, this problem was solved. It was found that a cure could be effected by eradicating all diseased tissue including that in the ethmoid and sphenoid sinuses. What was it that kept men from taking advantage of the knowledge which had taken so long to acquire? The hideous deformity was the specter that stalked the surgeon and stayed his hand. The surgeons knew the cure, but the price was too great to pay. From the time of Riedel the problem was to get his results without the deformity. There are those who still say that it cannot be done. Hajek insisted that all the recesses of the sinus cannot be cleaned out without removing a portion of the anterior wall. As late as 1927 Dr. Mithoefer said, in a paper before this section, that when a surgeon begins to think about cosmetic effect, he endangers the success of his operation. I believe just as firmly that it is possible for the surgeon to think primarily of cosmetic effect and at the same time to achieve success.

What is the ideal for which surgeons have been consciously or unconsciously working? First, it is to free the patient of his disease, second, to avoid deformity, third, to shorten as much as possible the period of convalescence, and fourth, to lessen the danger to life. Now if anything has been learned, it has been learned from Riedel that one cannot assure cure of empyema of the frontal sinus without destroying all diseased tissue. Then if one is to have a cure without deformity, all diseased tissue must be removed through the floor of the frontal sinus without disturbing the anterior wall. Hajek and other writers to the contrary, I have found this entirely possible in the eleven cases in which I have operated. Some of these patients had very large frontal sinuses extending to the external angle and up to the hair line. With properly curved curets, every angle of the sinus could be reached and the diseased membrane removed.

My study of the literature and my practical experience in twelve cases lead me to form certain conclusions in regard to the external

operation on the frontal sinus First, I think it is eminently a three-stage operation In practically all cases, in addition to the frontal empyema, there is empyema of the ethmoid, sphenoid and maxillary sinuses Do not be in too much of a hurry Take plenty of time to clear up the antrum and ethmoid As the drainage from the ethmoid, the sphenoid and the antrum decreases, the patient's general condition improves The resistance for the final operation is greater and there

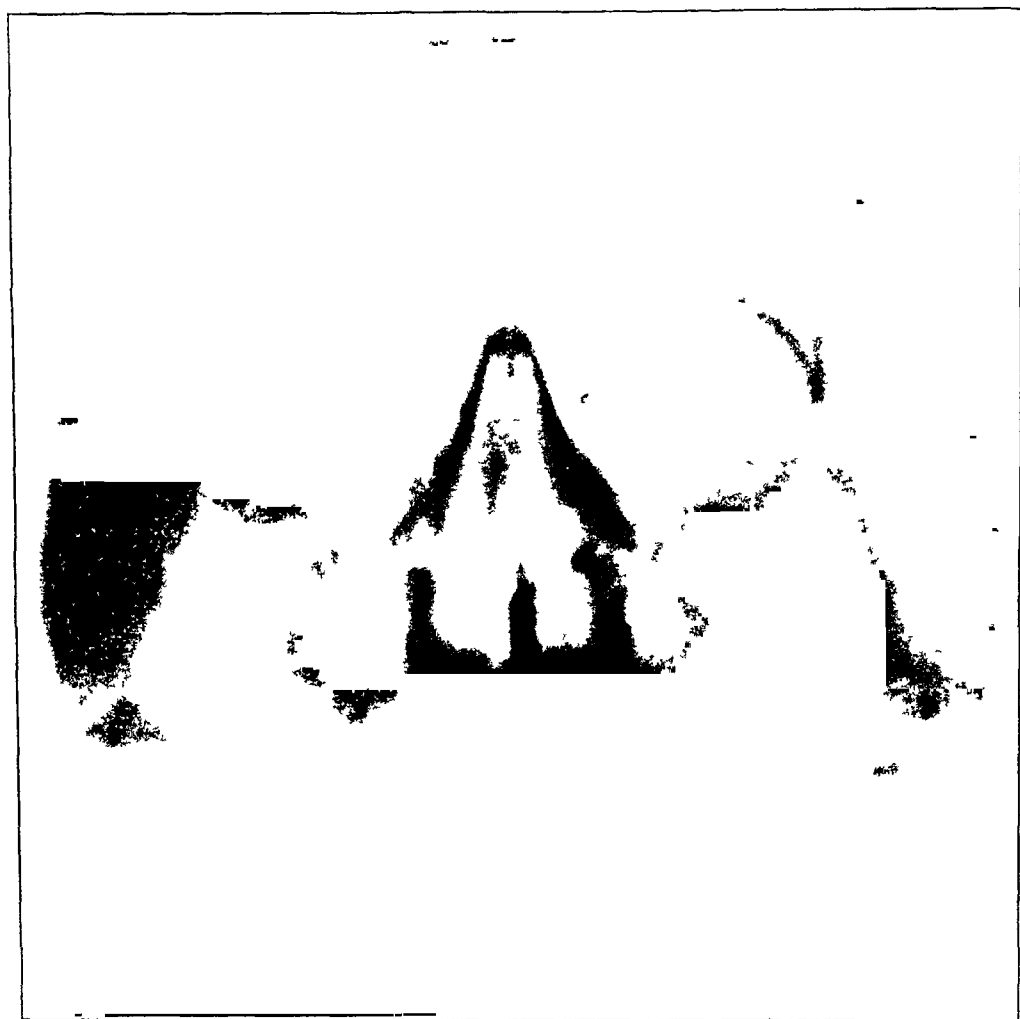


Fig 4—Roentgenogram of C W, operated on July 22, 1926 An interesting feature of this case is that both the right and the left frontal sinuses empty into the left nostril As can be seen, the interfrontal septum is squarely in the center The right nasofrontal duct passed over into the left nostril at about the level of the roof-cells of the ethmoid The left frontal sinus has been operated on externally and the operative defect can be seen in the floor of the left sinus The right frontal sinus was operated on later

is less to do Thus the operation is shortened the shock is curtailed and the area from which infection might arise is lessened Operate on the antrum first, then in a few weeks on the ethmoid and the sphenoid Do as complete an exenteration of the ethmoid as it is possible to do

intranasally, then in a few weeks do the external operation. It can be done quickly with a minimum amount of trauma and shock.

The bugbear of the external operation on the frontal sinus is recurrence. There are, of course, many factors that may be responsible for this. But in the present day when the operation on the frontal sinus is better understood than ever before, I think there are three factors that interfere with the success of the operation. First, failure to remove entirely the floor of the sinus makes it difficult to remove all the diseased membrane. Niches and angles are left behind where the diseased membrane is harbored and overlooked and the result is a recrudescence of the infection. The other two factors, to my mind, are responsible for most of the recurrences, namely, failure to deal adequately with the paper plate and failure to deal thoroughly with the ethmoid labyrinth. The whole success of the operation depends on a wide drainage area into the nose. The last paper on this subject read before this section was by Dr. Mithoefer, and I think it is legitimate to discuss his conclusions. He advised removal of only as much of the floor as is necessary, and his illustrations indicated that he left a certain portion of the floor. He further warned against removing much of the paper plate. He said that if a paper plate is extensively removed there is danger that the orbital fat will prolapse into the nose and close off the drainage space. There are practical dangers, and there are theoretical dangers. I think this is decidedly a theoretical danger. In the cases I have had, there has not been the slightest indication of a prolapse of the orbital fat, and I have made it a point to remove all the paper plate possible. Lynch does the same thing and in his large series of cases, he has made no mention of such a thing. Dr. Mithoefer, in common with other men, speaks of saving the middle turbinate bone. This is another thing to which I cannot subscribe. After the ethmoid has been exenterated, I cannot see the good of trying to save the middle turbinate. My belief is that it should be thoroughly and completely removed at the time of the preliminary ethmoidectomy. The statement that removal of the middle turbinate is followed by crusting is not borne out by the facts. Crusting did not occur in any of my cases. I think, rather, that crusting is an indication that some of the infected ethmoid cells have been overlooked, or that there is diseased tissue left in the frontal or the sphenoid sinus. To my mind, a middle turbinate left behind is only an additional obstruction to drainage and a possible hindrance to a complete exenteration of the ethmoid labyrinth. In recapitulation, therefore, I believe that the greatest cause of recurrence is failure to remove the floor of the sinus completely, failure to remove the paper plate and failure to remove all ethmoid cells and the middle turbinate.

I was somewhat puzzled by one of the causes listed by Dr. Mithoefer as a reason for postoperative retention, namely, the removal of too much of the mucous membrane of the posterior wall of the ductus

nasofrontalis Of course, there is no ductus nasofrontalis after the complete removal of the ethmoid cells and the floor of the sinus, as one can easily see by looking at the specimen How could one insert a half inch drainage tube if any part of the ductus nasofrontalis had been preserved? I remove the ductus nasofrontalis together with all its mucous membrane and make a new and greatly enlarged one

In this series of twelve cases, I noted some points that were of great interest to me The first one that I shall take up is the question of involvement of the bone There were three cases in which necrosis of the bone was found In two cases there was fistula formation, together with necrosis of the posterior wall In one case the dura was exposed over an area about as large as a half dollar A good part of



Fig 5—C H F, who had an external operation done on the right frontal sinus on April 21, 1928 In nine months, the patient had had one external operation and nine intranasal operations

the posterior wall was gone In the other, the area was a little larger than a quarter of a dollar In the third case, there was a fistulous opening between the left and the right frontal sinus

There was one point in common between all three cases, namely, there was no drainage into the nose in any of them In one case a bony tumor had been removed externally from the antrum and ethmoid region by Dr Crile The depressed scar which followed resulted in complete obstruction of the drainage system of the frontal sinus The first indication of frontal abscess was fistula formation in the floor of the sinus and operation disclosed necrosis of the posterior wall In another case, the first indication of pus in the frontal sinus was disclosed by fistula formation in the orbital roof and orbital cellulitis In the third case, the fistulous communication between the left and

right frontal sinuses was found at operation. This leads me to think that the bone is not likely to be attacked by necrosis in empyema of the frontal sinus unless there is complete obstruction to drainage. There was one case of gangrene of the mucous membrane. The entire mucous membrane was a grayish black and bathed in a dark ichorous discharge.

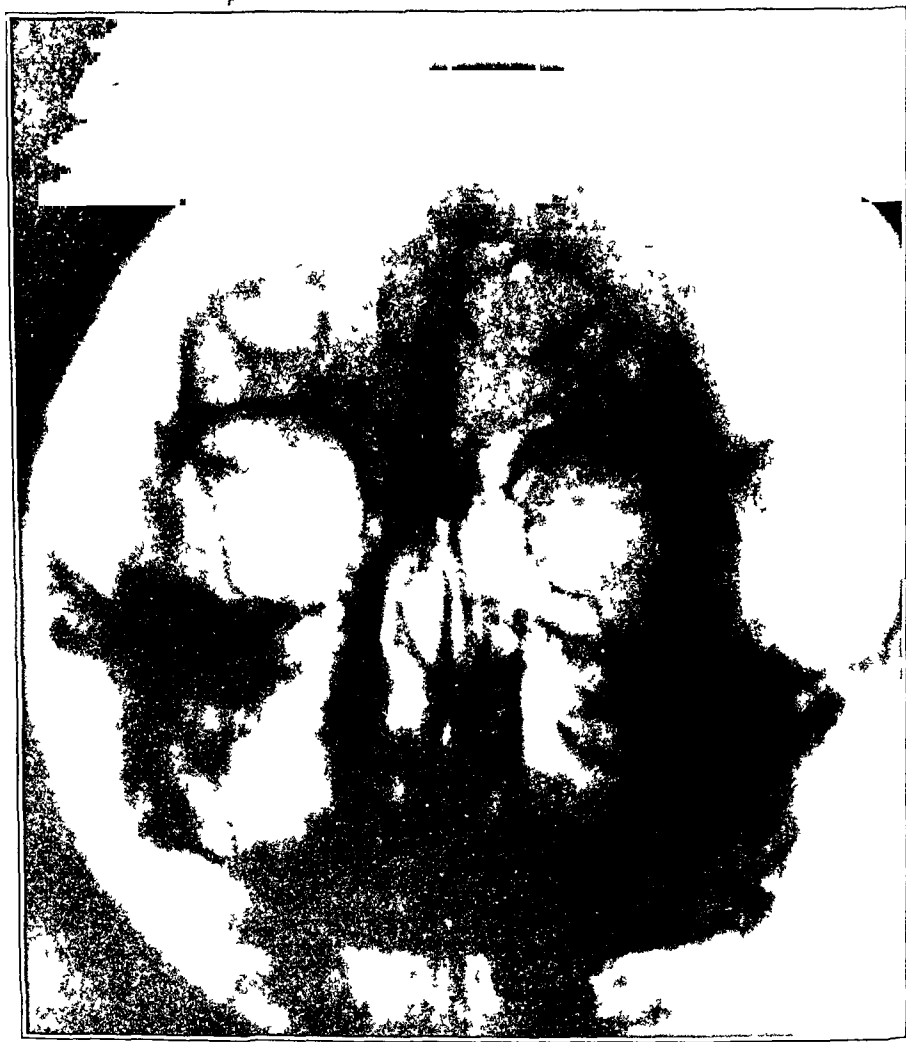


Fig 6—Roentgenogram showing ethmoid cells entirely out of the reach of the intranasal operative technic, also showing why it was not possible to establish drainage by means of an intranasal operation.

The membrane slipped from the periosteum easily and was dislodged without effort. This patient gave a history of unilateral headache over a period of several years. When she consulted me, there was no discharge in the nose, and there was none during the period that I watched her. A roentgenogram disclosed the condition of the sinus, but it was several months before she would consent to an operation.

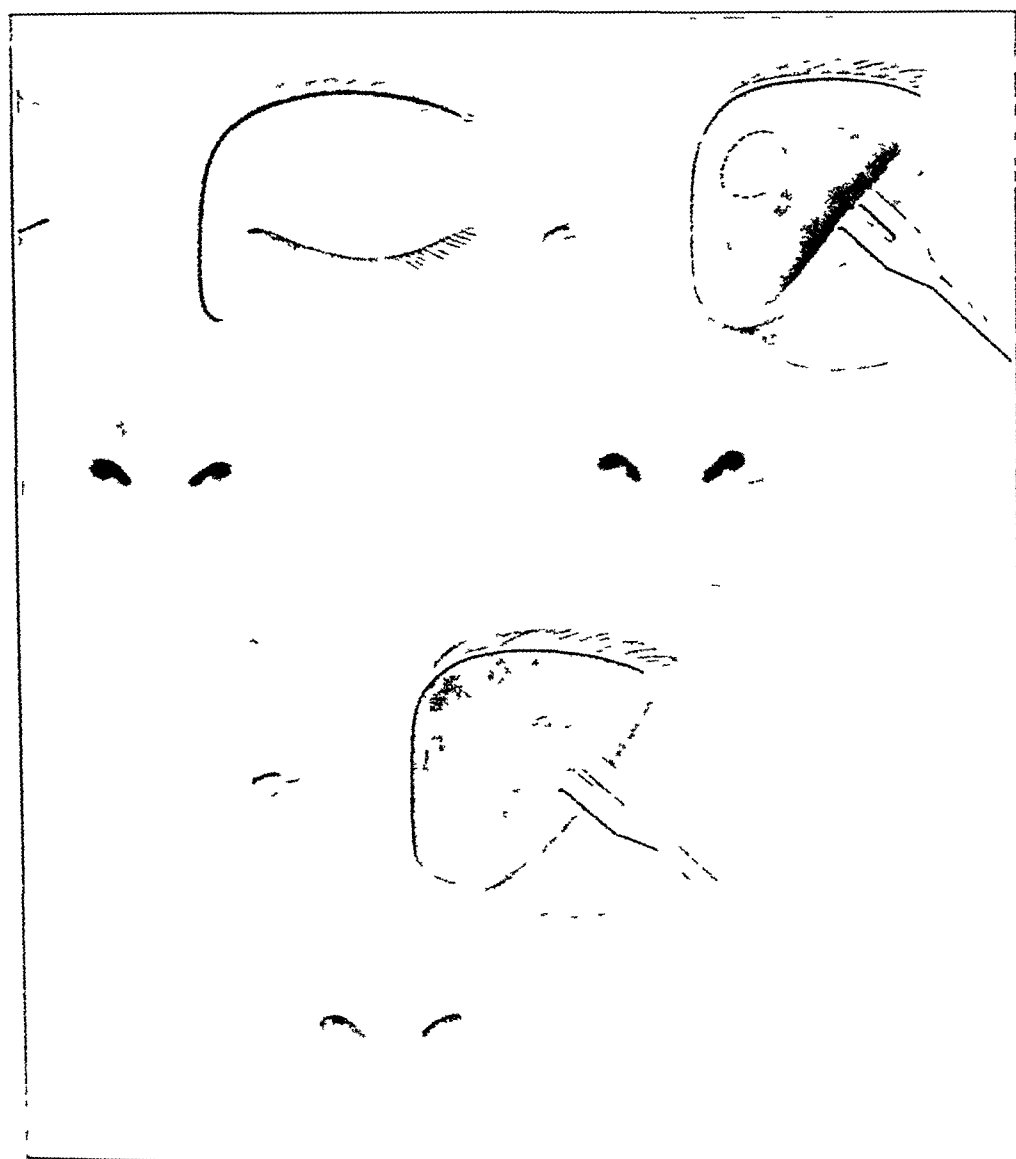


Fig 7—The first figure shows the line of the skin incision. The next shows the elevation of the soft parts. Note that the periosteum is not elevated above the line of incision. This is a point insisted on by Dr. Lynch. Elevation of the periosteum above the line of incision is not necessary to the technic and increases the danger of osteomyelitis. In the lower figure it is seen that the entire floor of the frontal sinus has been removed to the uttermost recesses and the mucous membrane of the rest of the sinus has been carefully curetted away. The paper plate together with all remaining ethmoid cells has been completely removed. In order to do this thoroughly it is necessary to remove the nasal process of the superior maxilla, the lower lateral edge of the nasal bone and the lacrimal bone.

The same condition was operating in this case as in the case of bony necrosis, and no doubt the necrosis of the mucous membrane would have been followed by necrosis of the bone

Hajek devoted considerable space to the discussion of empyema of the frontal sinus, uncomplicated by involvement of other sinuses. To my mind, a discussion of this kind is more or less academic. No case of chronic empyema that I have ever had was isolated, and I can hardly visualize a case of chronic empyema of the frontal sinus that would not involve at least the ethmoid on that side. In fact, I have had only one case that did not show involvement of the antrum on the same side, and I have the feeling that involvement of the ethmoid, sphenoid and antrum on the same side is the rule.

TECHNIC OF THE EXTERNAL OPERATION ¹⁰

The teeth and gums are inspected and are painted with iodine at the time of operation. The nose is swabbed out with a 50 per cent solution of iodine. The face is prepared in the usual way with iodine and alcohol, the entire face to the lips is painted on both sides and wiped off with alcohol. A postnasal plug is inserted. The brow is not shaved, and a pad of gauze is placed over the eye. The incision is the usual Killian incision through the eyebrow and down the side of the nose to about the lower level of the bony orbit. The hemorrhage, which is rather profuse, is controlled with artery forceps, and they are left in place, as I try to get along with as few ligations of the vessels as possible for fear of catgut infection. For this reason, I use mosquito forceps.

Now comes an important step of the operation. The periosteum is elevated only below the line of incision. The anterior wall of the frontal sinus is not touched. This is a very important point for two reasons. It does away with the deformity, and it lessens the danger of osteomyelitis. Here is one of the distinctive features of the Lynch technic. The periosteum is elevated with great care from the floor of the frontal sinus and over the nasal bone. I use an ordinary submucous elevator for this part of the operation. Great care must be exercised in elevating the periosteum around the lacrimal sac. There is no need to pay any attention to the attachment of the superior oblique muscle, except that the periosteum should not be buttonholed. When the periosteum has been elevated carefully over the whole field, I make an entrance to the frontal sinus at the inner angle with a gouge and mallet. I then explore the frontal sinus with a probe to determine its extent.

Now comes another important step in the operation. The floor of the frontal sinus is removed completely with biting forceps, and there must be absolutely no recesses left. The granulation and the diseased mucous membrane is curetted away with the utmost care. A curved curet is best for this. It might be well at this point to comment on a criticism that has been made by Hajek and others, namely, that it is not possible to curet the frontal sinus completely without attacking the anterior wall. I have had some very large sinuses extending over to the external angle and up to the hair line and I have been able to clean them thoroughly through the floor. In one case at operation I found a sinus extending from the left frontal into the right frontal sinus. I removed the septum between the two and curetted the left sinus thoroughly through the opening into the right

¹⁰ Lynch. Laryngoscope 31:1 (Jan) 1921.

with perfect success. When the diseased mucous membrane is thoroughly curetted out, the frontal sinus is packed with gauze soaked with iodine.

The next step is also an important part of the operation. I remove the nasal process of the superior maxilla, the lower lateral edge of the nasal bone, the lacrimal bone and the entire paper plate. In removing the paper plate and the external bone ethmoid cells are encountered that I have been unable to remove intranasally. I am able to make a clean sweep and to get rid of the diseased bone at the inner angle of the brow or orbital recess which it seems to me is overlooked in the usual Killian operation. By the removal of the paper plate and the remaining ethmoid cells, I find a large opening down into the nose through which I introduce a half inch drainage tube from above and bring it out the nose. It is my custom to insert a small rubber tube inside the large tube which gives the tube a certain stiffness that makes it easier to insert. The small inner tube is removed the following morning and keeps the large tube from getting obstructed with blood clot. Two deep catgut sutures are now taken in the depths of the wound and anchored not to the periosteum above but through the muscle and skin, the point being not to introduce any avenue for infection into the periosteum of the upper part of the wound. The external wound is closed with Michel skin clips. The eye is flushed with 20 per cent mild silver protein, covered freely with sterile petrolatum and a generous gauze dressing and a pressure bandage is applied. The following morning, the small tube is removed, alcohol is dropped into the large tube and a large sterile piston syringe is used to suck it back through the tube. It is surprising how much secretion this will bring out in the way of blood clot and detritus. This will keep the tube open for drainage. The purulent discharge disappears at once and does not recur. This dressing is performed each morning for from eight to ten days, then the drainage tube is removed, and the patient is to all intents and purposes well. You will notice that there is no irrigation of the wound at any time as is advised by many operators, nor is there any irrigation afterward. I think such a procedure is uncalled for and is dangerous.

ABSTRACT OF DISCUSSION

DR WILSON JOHNSTON, Portland, Ore. We are not agreed as to the best type of operation for the frontal sinus. We are gradually becoming well crystallized as to the cause of our failures, that being the failure to remove the nasal frontal ethmoid cells, failure to remove completely the diseased mucous membrane, and failure of the enlarged nasal frontal duct to remain patent. I have no quarrel with Dr. Cullom as to his method of approach in his operation. As I look back over my own cases I find that nature tries to teach us that the approach through the floor is her method. In the majority of cases of orbital cellulitis we find the roof of the orbit or the floor of the frontal sinus perforated. That was the condition in the first frontal sinus on which I operated, and in approaching that I followed the path nature had shown me and removed the floor. I was able to use a curet and to remove the diseased mucous membrane, enlarging the opening into the nose somewhat. The whole cavity was packed externally, and the patient was cured.

Dr. Cullom says he can and does remove all of the mucous membrane through an opening in the floor. I am sure that in the twelve cases reported he has not had a case like one I had recently in which in the frontal sinus the space between the two plates was not more than a millimeter, and it was necessary to remove the external plate in order to remove the diseased mucous membrane. I think the majority of us will agree that it is very difficult, if we are going to remove all of the mucous membrane and remove it thoroughly, to do so from below, because

there are recesses and ridges that make it almost impossible. It is, therefore, my procedure to remove the floor and as much of the paper plate as I can, then remove the anterior ethmoid cells, and after I have outlined the frontal sinus, to go to the upper border and open through the frontal plate, remove one-quarter inch completely around the upper border so that I can then remove all of the ridges and all of the mucous membrane above. Little deformity results from removal of the bone and the procedure permits me to be sure that I have removed all of the mucous membrane, which I consider is the most important part of the operation. Dr. Cullom said that he removed diseased bone and exposed the brain membranes. I cannot see how any surgeon has the temerity to do that and then close up the frontal sinus wound. We do not do it in operations on the mastoids when we expose the meninges, and there we have a greater opportunity for drainage than we have in the frontal sinus. I am more and more convinced that the operation that will give us the greatest number of cures is an operation similar to that used by Dr. Cullom—the operation that gives complete removal of the diseased ethmoid cells, of the diseased mucous membrane, and then allows for external packing for the obliteration of the frontal sinus cavity.

DR. ROSS HALL SKILLERN, Philadelphia. It is most interesting to hear Dr. Cullom give a resume of some of the older operations, because it was just at that time that I began to be interested in laryngology, around 1900. I recall well the controversies at that time and how everyone stood his own ground and seemed to take sides in the discussion. Coming to the operation he has described, of course, we all know that it originated with Jansen of Berlin in the late nineties, was later taken up by others, and finally Dr. Lynch modified it and removed many of the dangers so that now it very deservedly bears his name. Dr. Cullom said, "First of all, I think it is manifestly a three-stage operation." I am sorry that I cannot agree with him. I think it may be a two-stage operation, but usually when a patient comes to us someone else has already performed the first stage. In some cases the maxillary sinus is not involved, and if it were, a couple of needle punctures would clear up the involvement. So it seems to me that this operation is one on which we must concentrate and make sure that it is the infection in the frontal sinus that is causing the symptoms, and that that is the location to which we must give surgical attention.

Dr. Cullom said further, "There are three factors that interfere with the success of the operation. First, failure to remove the floor of the sinus entirely." I presume he means in this particular operation, for certainly in operations in general we do not disturb the floor of the sinus unless we are compelled to do so. Then he speaks about the whole success of the operation depending on a wide area of drainage into the nose. I think there he is wise. I believe that a great deal of the success of our external operating on the frontal sinus is due to the wide opening we get afterward, although it is not drainage that counts as much as ventilation. If we get thorough ventilation, if the air circulates well through these parts—frontal, ethmoid and maxillary sinuses—our chances of ultimate success will be much better than if we depend on drainage alone.

Another thing I wish to endorse unreservedly, is what Dr. Cullom says about the removal of the middle turbinate bone after the ethmoid has been everted. I do not see why it is necessary to preserve a structure of which none of us know the exact function. You may say because it helps to warm the air. Perhaps it does, but what does the inferior turbinate do? I think we can easily get rid of the middle turbinate without hurting the patient. Therefore, to be on the safe side I feel it is better to get rid of this structure entirely, as it does interfere with drainage and most certainly it interferes with aeration. I have never seen a case in which harm came from removing the middle turbinate.

Regarding the operation itself We have two indications for operation on the frontal sinus—one absolute and one relative, one of choice and one of necessity Our operation of choice is the Lothrop method, which is modified so that we do not take out the large part of the nasal septum, and make a small opening we do, however, make a large opening into the nose This may also be the operation of necessity, this depends on the amount of bone involvement If considerable of the bone is involved near the eye and the orbital plate, of course, it has to be removed So the operation which Dr Cullom recommends comes in well for one of necessity, rather than one of choice, but after all it is the final results that count In the final analysis it matters little what we do, but how we do it After we have done the external operation it depends on the results It is not the special technic, but rather the results obtained that concern the patient

DR ARTHUR C JONES, Boise, Idaho I hardly feel that I can have a one type operation for all frontal sinus infections The type of pathologic process I find in the sinuses, the roentgen observations, the character of the discharge and the physical condition of the patient help me to decide on how extensive the operation will be in order to give my patient relief As to the number of stages in the operation, I rarely see a patient until he has been operated on at least once, but if I am fortunate enough to see him before he has had any operation I generally use two stages I do not recall seeing any case of infection of the frontal sinus in which there had not been at least an infection of the ethmoid and most generally an infection of the antrum In the first stage, that is, the operation on the antrum, I do not do a simple puncture as suggested by Dr Skillern I find it necessary to do a radical operation In checking over my cases of operations on the antrum over a period of five years, I find that the patients who have had radical operations are much freer from recurring infection and persistent discharge than those who have been treated more conservatively Extensive ethmoid infections are handled much more satisfactorily when an external operation is done In regard to cleaning out the paper-thin bone, I have never seen any indications of the orbital fat extending into the nose and shutting off the drainage I want to congratulate Dr Cullom on the excellent results he has secured by this method Perhaps some of the operations I have been doing have not been done carefully enough For the past six years I have been doing all my operations under local anesthesia It certainly lessens the amount of bleeding at the time of operation, and when it is possible, instead of using a curet I do a subperiosteal elevation and remove the entire mucous membrane in one piece I feel much more certain that I have not left any isolated bits of diseased epithelium in the antrum This can be done much easier by using a local anesthetic

DR R H T MANN, Texarkana, Texas It is indeed strange that so much confusion still exists regarding the proper operative procedure to be taken in sinus infections Sinus operations should, and as a matter of fact do, result in cures in as large a percentage of cases as other operations, when a correct diagnosis has been made and the operation suited to that particular case has been performed An open or radical operation should be performed in all except acute cases If a thorough inspection has been made and all the diseased tissue has been removed and free intranasal drainage established, a cure is uniformly to be expected In discussing with Professor Killian many years ago the cause of failure in such a large percentage of cases following his operation when performed by other surgeons, and giving such uniformly good results when done by himself, he said there was not more than one operator in fifty who was fully cognizant of the technic of his operation I have been a student of Killian's—that was when he first devised his operation—and since that time I have uniformly

employed a modified Killian operation in these cases. It has been as successful as any other operation, and there has been practically no mortality following the operation. I think a thorough extenteration and cleaning out should be done, and I am sure when that has been done that many less failures will occur in operations on the frontal sinus than are now being reported.

DR JOHN F BARNHILL, Miami Beach, Fla. This paper has brought out many points which are still controversial. Both paper and discussions have also brought forward the fact that no one operation is suitable to all cases. With our modern means of finding out the nature and extent of the pathologic process in the sinus and how extensive the disease is, we are usually able to determine beforehand with a good deal of precision what operation is most suitable. In the days before the Killian operation became as well known as it is now, operations on the frontal sinus were often successful because in performing the Kuhnt operation the frontal wall was taken away. All the pathologic process was removed, and the sinus was then packed daily until healing by granulation occurred. This required about three months, and the scar was often unsightly. I occasionally see one of these patients on whom I operated more than twenty years ago. They remain well even if unfortunately they bear a scar. Since Killian came to America and demonstrated his operation I have adopted it in suitable cases and have found it satisfactory in well selected instances.

I agree with Dr Skillern that the anterior wall of the sinus, in case the cavity is large, must be removed if one is to be sure that the operation is being done that will result in cure, for the upper angle where the two tables of the skull come together is frequently so narrow that it would be absolutely impossible to remove all the disease which lies in this narrow space except by an operation which removes the entire frontal wall. It occurred to me as Dr Cullom showed his pictures that in his particular cases it would have been wholly impossible to remove the mucosa from the upper angles of the sinuses as successfully as he must have done by any type of operation which did not remove the anterior wall.

Just two things are necessary for success in any operation on a septic, noncollapsible cavity. The first is to remove all of the pathologic process. The second is to secure adequate drainage then and afterward until healing has taken place. Dr Skillern said that ventilation does great good. That is true for the very fact that air enters the cavity freely is an indication that there is also ample provision for necessary drainage.

DR ROBERT C LYNCH, New Orleans. Referring to conditions of the frontal sinus, when I read my first paper the first sentence was, "after all else has failed, try this." That little sentence covers a multitude of sins, and I think does away with the necessity of one, two or three-stage operations. If the antrum is diseased, it should be taken care of first and by the various methods which are our property—irrigation or radical operation. The patients that we operate on for conditions of the frontal sinus have an infected antrum and an infected ethmoid and sphenoid as well. Many of them have been operated on before, and the pathologic process is so definite and characteristic that diet, sunlight and constitutional medication, and cell habitation that has been spoken of in the last two or three weeks, will not restore the normal condition. If operation on the antrum is done instead of on the ethmoids, clean out the antrum as much as possible and open the sphenoid sinus. The idea is to get rid of as much membrane as possible and do it thoroughly. If the membrane is not gotten rid of completely, crusting will occur after the operation, and crusting is an evidence of incomplete operation.

Dr Barnhill and Dr Skillern and some of the other men spoke of drainage and ventilation after operation. I do not think either drainage or ventilation is

necessary or of any consequence I have not found one sinus in which it is not possible to reach the apex, that is, the point between the frontal plate of the frontal sinus and the partition that forms the outer wall of the anterior cerebral cavity or the posterior wall of the frontal sinus. When that whole floor is taken away, and it extends up to the hair line, see that these two plates are anatomically separated. In those cases, the sinus is large. A long narrow projecting sinus with only 1 mm difference between the anterior and the posterior wall, so far as I know, has never been exhibited in any of the anatomic specimens which I have seen or of which pictures have been exhibited. I do not think it exists. The larger the sinus the greater the separation, and the greater the separation the easier the removal. When the sinus is smaller the removal is proportionately easy. It cannot be done with a large curet, the instrument must be adapted to the work in hand. After the walls of the ethmoid and sphenoid cells are removed, there is nothing to drain, there is nothing to ventilate. Insert a small rubber tube, not over one-half inch in size or less than one-quarter inch, and a no. 16 catheter is all that is used. Leave it in not more than three days, and then let the patient alone.

DR M M CULLOM Dr Johnston spoke of having a sinus with 1 mm between the plates. I have not found that. Of course, if such a condition should be encountered, and the anterior plate is removed, there would not be much resulting deformity. One has to deal with each case as it occurs.

Dr Johnston spoke of the danger of exposing the dura. I did not expose the dura. Nature did that. There was necrosis of the posterior wall and I merely freshened the edges of the necrotic area where nature had already exposed the dura. I do not think there is the least danger in leaving a condition of this kind. There is wide drainage and nature is only too glad to seal this place if the pus is given a chance to get out some other way. Nature is only trying to find an outlet for the pus that is pent up.

I am much in accord with Dr Lynch's last remark about the thoroughness of the operation. I think a thorough operation is far safer than a partial one. In the case I spoke of in which the young man had had nine intranasal operations and one external operation, I did a complete external operation. The patient was a very sick boy and had a temperature of 103 F. Some of my surgical friends advised me to open the sinus externally and to make no attempt to curet. My belief was that it was far safer to clean out all the diseased tissue and get thorough drainage than to make a partial effort and leave so much disease behind.

Dr Lynch deprecates the use of a large drainage tube as unnecessary. I bow to his greater experience and allow that a small drainage tube left in for only three days may be sufficient, but I cannot help feeling that as large a drainage tube as one can insert left in for a week or ten days is safer and more rational. The pressure of the tube discourages the springing up of granulation, and I think insures a larger drainage opening for a longer period.

I am much in accord with Dr Skillern's remarks. He was very kind, and I think we are in agreement on almost all points. The main point is to get rid of all the diseased tissue. I was especially pleased at his strong endorsement of the complete removal of the middle turbinate. In this series of cases, three patients developed cellulitis. Some of my surgical friends said, "Open these sinuses and see what is the trouble." My reply was, "What do you expect to find when you open them?" All diseased tissue has been thoroughly removed, and I think we would accomplish nothing by opening them, besides it would be highly dangerous to open up the wound in the presence of cellulitis.

RHINOPLASTY

FACTS AND FICTION *

GEORGE D WOLF, M D

NEW YORK

This paper is prompted by the desire to stimulate discussion to focus attention on a subject that has hitherto been regarded by the medical profession with mystified reverence, open derision or frank apathy

This material is presented, not from the point of view of the rhinoplastic surgeon, but from that of the rhinologist who considers rhinoplastic surgery a part of his work. It is confined to intranasal procedures for the correction of nasal deformities

HISTORIC BACKGROUND

The history of surgical procedures for nasal deformities is relatively younger than that concerned with nasal construction¹. As early as 1848, von Dieffenbach mentioned nasal shortening in his "Operative Surgery". He cited two instances—one in which he corrected the ala nasi in a large nose and another in which he dealt with the reduction in a large but apparently normal nose—corrected through a cross incision of the skin and cartilage. His methods, however, were subsequently forgotten.

In 1887, John Roe, an American, reported the successful correction of a pug-nose. For such cases, he resorted to the removal of superfluous tissue, in cases of too broad nasal tips, he incised the ala nasi at different places and then used a saddle apparatus. In 1892, Robert Wen, also an American, reported the correction of an overly prominent nose. However, most of these subcutaneous corrective operations were hardly satisfactory.

All this work was soon forgotten, nor did it leave any permanent impression on the European literature. Certainly, up to 1898 no description of nasal surgical procedures for reductive or constructive purposes is recorded. In 1898, Jacques Joseph, unaware of the previously mentioned authors, performed by his own method an operation in which

* Submitted for publication, July 10, 1929

¹ Read before the Section on Laryngology, Otology and Rhinology at the Eightieth Annual Session of the American Medical Association, Portland, Ore., July 12, 1929

¹ Joseph, J. *Korrektive Nasen und Ohrenplastik*, in Katz, L., and Blumenfeld, F. *Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege*, Leipzig, Curt Kabitzsch, 1921, pp 261-262, vol 1

a nasal hump was reduced and the tip was shortened and made narrower. He accomplished this by removing a portion of the septum just underneath the hump, then fracturing the attachment of the nasal and maxillary bones and pressing in the nasal ridge. In 1902, Joseph reported a case in which he corrected an abnormally forward protruding cartilage (the so-called potato-nose).

Neudorfer, in 1903, reported an extranasal subcutaneous hump reduction, Nelaton and Ombredanne, of Paris, cited two Americans, Smith and Monks, who in 1895 and 1898 carried out similar operations. In 1904, Joseph described the intranasal hump reduction (performed without touching the external skin), and in a further publication described the narrowing of the bony nose, as well as the reduction of the large protruding septum. In 1905, he described the operation for shortening the nose without external scar formation and in 1907 the narrowing of the nasal tip through intranasal band excision. In 1910, at the gathering of the German Society for Natural and Medical Sciences, he described further improvements in the scarless shortening of the nose through decortication and removal of skin, as well as corrections of skin disfigurement of the ala nasi and the nasal tips.

THE STATUS QUO

Although rhinoplasty was practiced as early as the middle of the fifteenth century, the greatest impetus was given to this work by the World War. Its relative newness and comparatively spectacular achievements inevitably led to a great deal of public attention. The press, exploiting the purely sensational angle, devotes considerable space to each popular personage who has submitted to surgical operations changing the shape of his nose. Large and profusely illustrated articles in Sunday editions describe in great, if erroneous and exaggerated, detail the work of the "plastic surgeon," with particular emphasis on sensational aspects as being of the greatest "news value." The general awe in which the laity regard the miracle men capable of performing such wonderful operations, without scarring the face, has extended even to some members of the medical profession.

The very name "plastic surgery" is a popular error. If the term plastic signifies "that which tends to build up tissue," the current phrase is a misnomer when used in reference to intranasal methods. "Cosmetic surgery" is the more accurate name, and "plastic surgery" should rightfully be reserved for treatment resulting in rebuilding an organ partly or completely lost.

Cosmetic surgery, then, is within the province of the competent rhinologist,² despite the fact that the correction of nasal deformities

² Israel, S. External Deformities of the Nose and Their Correction by Intranasal Route, *South M J* **15** 326, 1920, *Texas State J Med* **17** 304, 1920.

has long been his bugbear. Those most familiar with the anatomy, physiology and pathology of the nose and paranasal sinuses, and those possessing proper medical background, should get the best results. The actual operative technic is not nearly so complicated as one is led to believe. Moreover, postoperative results can be fairly accurately visual-



Fig 1 (case 6) —Front view of plaster of paris cast model before operation

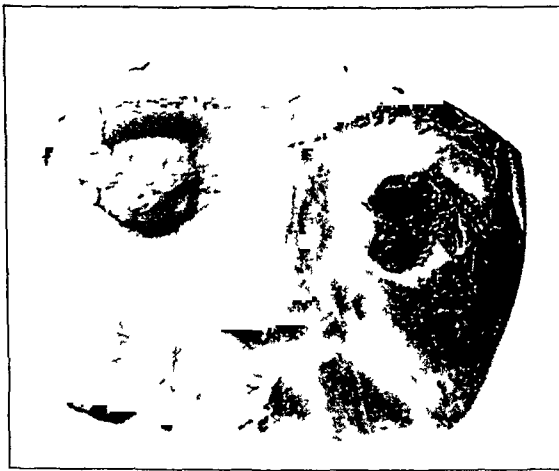


Fig 2—Same as figure 1, but showing deformity corrected on model

ized by preliminary work on plaster of paris models and photographs of the patients (figs 1, 2, 3 and 4)

To be sure, perusal of the literature on the subject leaves one rather confused. Contradictory statements are made, and descriptions are not always lucid. A few examples will serve to illustrate this point. For instance, Sheehan³ favored the columella incision as preferable to the

³ Sheehan, J. E. *Plastic Surgery of the Nose*, New York, Paul B. Hoeber, Inc., 1925, p. 7

intranasal, because it prevents infection and favors greater ease in the introduction of the instruments

Gillies⁴ recommended the columellar lift. Roberts⁵ preferred his horizontal incision at the tip of the nose. Frank and Straus⁶ spoke enthusiastically of their modified intercanthal operation. Lewis⁷ described a vertical incision in the lower half of the columna nasi. Tieck,⁸ in describing a new method, recommended the following: "A second incision beginning at the inferior part of the lower edge of the nasal bone, at the junction of the vomer is made." The discrepancy between this description and the actual anatomic facts is indeed puzzling. Hunt,⁹ in his book, presented a photograph of a patient



Figure 3

Fig. 3—Same as figure 1, lateral view

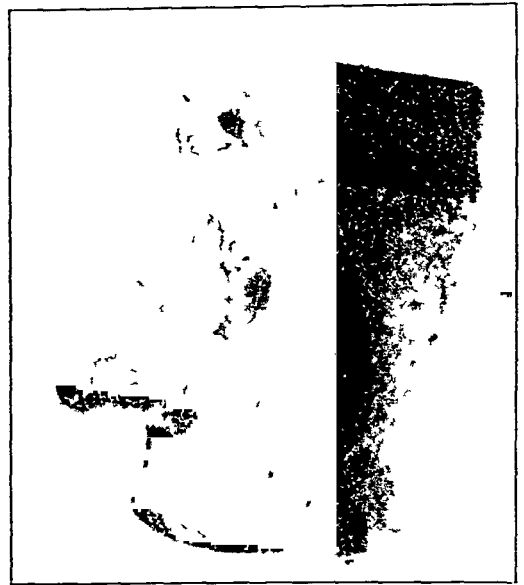


Figure 4

Fig. 4—Same as figure 2, lateral view

labeled "hump nose operation by author's method," but search fails to reveal a description of his procedure. Davis¹⁰ found cartilage trans-

4 Gillies, H. D. *Plastic Surgery of the Face*, Oxford Medical Publications, 1920.

5 Roberts, S. E. Nasal Hump. *Ann Otol Rhin & Laryng* **33** 1251, 1924.

6 Frank, I., and Straus, S. J. An Invisible Scar Method in Cosmetic Nasal Surgery. *Ann Otol Rhin & Laryng* **30** 670, 1921.

7 Lewis, J. D. External Nasal Deformities. *Laryngoscope* **32** 214 and 217, 1922.

8 Tieck, A. J. E. A New Method for the Correction of Nasal Deformities by Intranasal Procedure. Author's reprint, 1919, p. 3.

9 Hunt, H. L. *Plastic and Cosmetic Surgery of the Head, Face and Neck*, Philadelphia, Lea & Febiger, 1926, pp. 234 and 235.

10 Davis, J. S. *Plastic Surgery Its Pinnacle and Practice*, Philadelphia, P. Blakiston's Son & Company, 1919, p. 462.

plants most satisfactory, Hunt⁹ pointed out all the disadvantages of this medium and recommended the use of the patient's middle turbinate instead. Israel¹¹ saw no wisdom or need in sacrificing a normally functioning turbinate when cartilage is so readily accessible and is superior in withstanding infection.

QUALIFICATIONS OF THE COSMETIC SURGEON

Bettman¹² expressed the belief that the surgeon requires a certain amount of artistic judgment. Carter¹³ insisted that "the work requires a modicum of artistic talent, a God-given attribute distributed not to all who are called but only to those that are chosen."

Berne¹⁴ stated that "the artist's vision is just as essential to the surgeon who would excel in rhinoplasty as it is to the sculptor, even more so than to the painter, who deals, in the last analysis, with flat surfaces only." Unquestionably, these gifts are of great help. But without embarking on a discussion of contemporary esthetic theories, I may point out that one is dealing with living tissues, a medium which is vastly different from the sculptor's clay. Even in the best of hands postoperative results may prove disappointing, because of the contracting of scars, bony exostoses, the failure of the transplant to take or its curling. This is readily evident from the comparison of a photograph taken shortly before with one taken some time after the operation.

I believe that a rhinologist with a fair understanding of configuration and symmetry should obtain satisfactory results, particularly with the aid of preliminary work on plaster of paris casts.

The methods described in the literature are hard to comprehend and harder to follow, and the numerous drawings which accompany these descriptions are not of any great help. This statement refers particularly to the intranasal methods, although some exception should be made of Salinger's¹⁵ paper. Marshall¹⁶ offered an adequate description, yet his technic requires an external incision of the skin.

In a majority of cases, narrowing of the bridge of the nose is essential to secure good results. The English literature which I have encountered does not give a satisfactory exposition of this procedure.

11 Israel, S. Correction of External Nasal Deformities, *Ann Otol Rhin & Laryng* **32** 506, 1923.

12 Bettman, A. G. Plastic Surgery of the Nose, *Med J & Rec* **123** 499, 1926.

13 Carter, W. W. Correction of Nasal Deformities, *New York State J Med* **25** 1070, 1925.

14 Berne, Louis P. Modern Concepts of the Correction of Deformities of the Nose by Intranasal Methods, *Internat J Surg* **34** 344, 1921.

15 Salinger, S. Surgical Correction of Crooked Noses, *Illinois M J* **54** 368, 1928.

16 Marshall, G. M. Correction of Nasal Deformities, *J A M A* **60** 179 (Jan 18) 1913.

Therefore (although this paper was not intended to describe technic), I should like to avail myself of the opportunity to present these very important drawings of Professor Joseph¹⁷ and a brief description of his method (figs 5 and 6) (Details of asepsis and anesthesia are omitted)

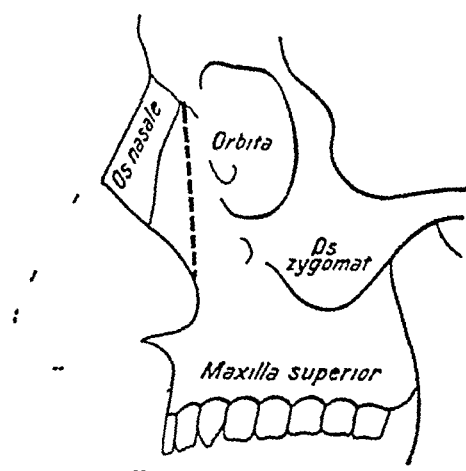


Fig 5—Narrowing of the bony nose. The dotted line gives direction and beginning of intranasal sawing (After J Joseph)

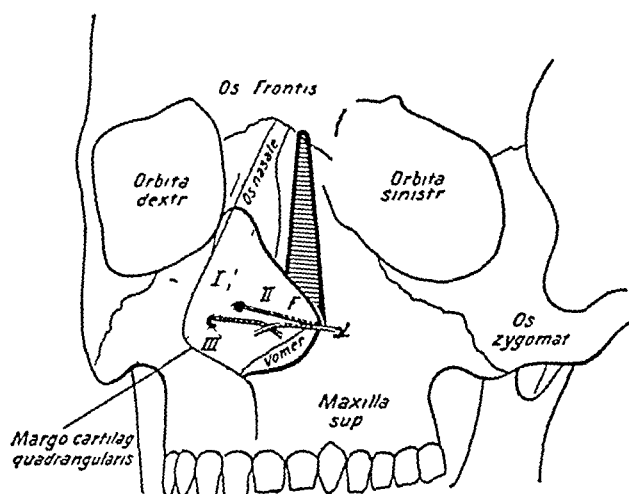


Fig 6—Correction of the bony and cartilaginous portions of a bent nose. Schematic oblique view of the skull in region of the quadrilateral cartilage. *L* indicates openings in superior maxilla through which a thread is passed and is attached to the cartilaginous septum, *F*, site and extent of the superior maxilla resection for the correction of bent nose (After J Joseph)

A transverse incision about 1 cm long is made within the nose at the inferior edge of the upper lateral cartilage (cartilagi nasi

17 Passaw and Claus. Operationen am Gehörorgan an den Tonsillen und in der Nase, ed 2, Leipzig, Ambrosius Barth, 1923. Cohen, Lee. Corrective Rhinoplasty, Laryngoscope 24 565, 1914.

laterales) at the junction with the cartilage of the septum. With a Joseph submucous elevator, the skin and the periosteum are carefully elevated. Another incision is made at the extreme lower end of the pyriformis opening on both sides. The periosteum is freed from the bone, from the lower external end of the pyriformis opening to the radix nasi and the bone is sawed with a knee-shaped Joseph saw, through the processus frontalis of the maxilla on both sides. The freed portion of the bone is bent toward the median line for the purpose of narrowing the bridge of the nose.

A personal visit to the various clinics where this work is done gives little more satisfaction. My experience, in a post-graduate course abroad, indicated that the practice of the methods taught there would be most disastrous to a living patient. The teacher, in this particular

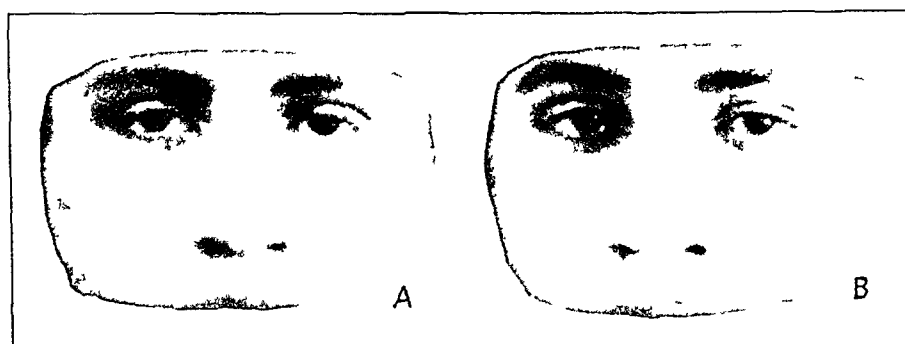


Fig 7 (case 1) —A, before operation, B, after operation

instance, discussed modifications of the Joseph method, but in a private conversation, he admitted that he was not familiar with the Joseph technic.

REPORT OF CASES

In his routine practice, the average rhinologist is occasionally confronted with problems necessitating his familiarity with corrective processes.

CASE 1 (fig 7) —A C, a boy, aged 16, presented himself at the clinic stating that two weeks previously he was hit with a bat. The immediate effects were inconsequential. For the past week he had complained of absolute obstruction to breathing. It did not yield to the ordinary home remedies. Examination revealed the mucous membranes of the lower part of the septum widely separated, and fluctuation was elicited.

A diagnosis of septal abscess of traumatic origin was made. The family was told of the situation and also warned that evacuation of the pus would probably result in a depressed nasal bridge, because treatment was too long delayed. In spite of this warning, the family hunted, subsequent to the operation, that the surgical intervention was responsible for the deformity.

Three months later, with the patient under general anesthesia, a part of the seventh rib was inserted into the nose. Although the transplant did not take, there was apparently enough scar tissue formed to cure the deformity.

Not infrequently, restorations of the normal functions of the nose cannot be accomplished without correction of the nasal deformity as well.

CASE 2 (fig 8)—In K. A., aged 35, a submucous resection, double ethmoidectomy and removal of posterior tips of inferior turbinates was performed to relieve obstructed nasal breathing. But not until the tip of his nose was shortened, thus enlarging the vestibule, was the desired result obtained.¹⁸

CASE 3 (fig 9)—J. T., a youth, aged 20, gave a history of nasal trauma resulting in lateral nasal deflection to the left of the entire nose, including the septum.

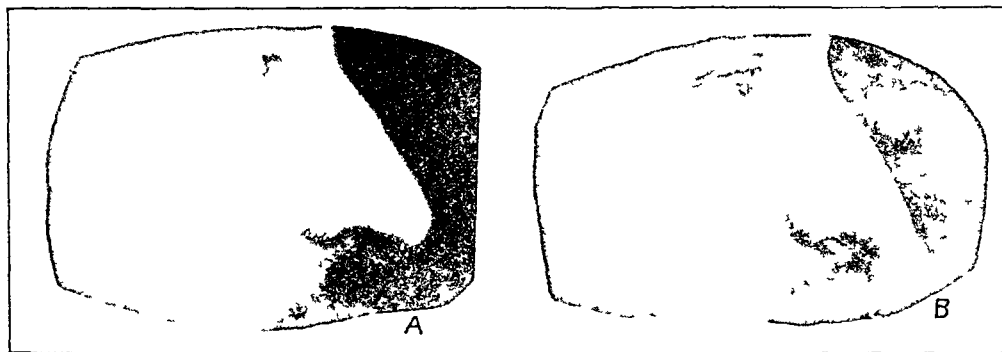


Fig 8 (case 2)—A, before operation, B, after operation

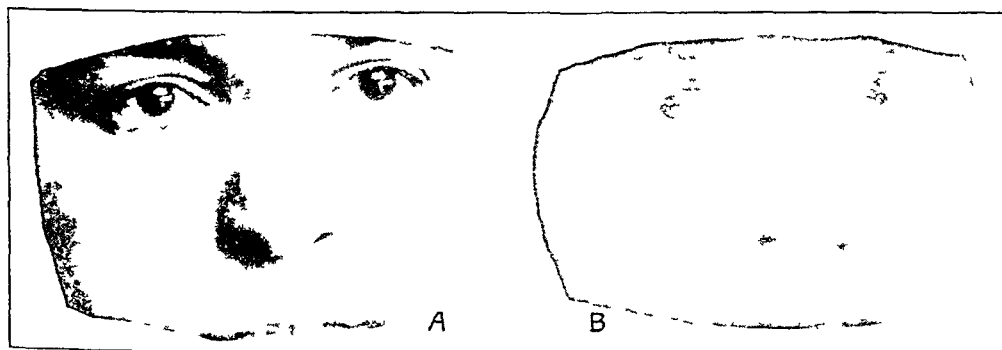


Fig 9 (case 3)—A, before operation, B, after operation

While he was chiefly interested in good breathing, this could not be attained unless the nose was restored to its original position, which was accomplished by breaking the old fracture and restoring the nose to normal.

CASE 4 (fig 10)—J. P., a man, presented a history and complaint similar to the patient in case 3. (The Gillies operation was employed here.)

CASE 5 (figs 11 and 12)—L. S., a girl, a student, aged 17, complained of collapse of the ala nasi at each effort of inspiration. She also had an unsightly, flat nose of the negroid type, which made her very unhappy. Her deformity was somewhat exaggerated after I performed a submucous resection. After narrowing the bridge of the nose and using a piece of the cartilage of the helix of her ear, a very satisfactory result was obtained, both cosmetically and functionally.

¹⁸ Blanchard, H. B. Corrective Rhinoplasty, Rhode Island M. J. 9 162, 1926

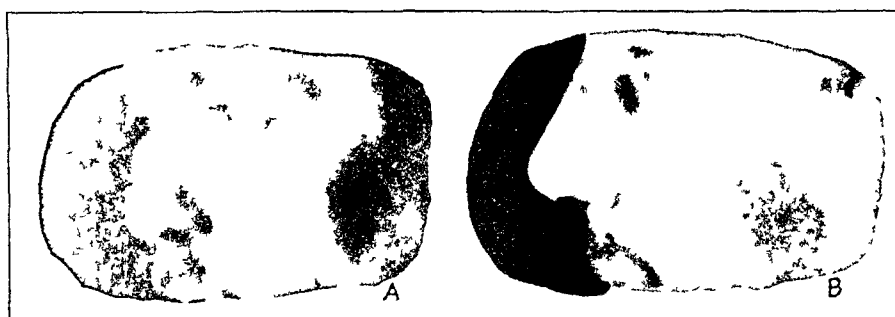


Fig 10 (case 4) — *A*, before operation, *B*, after operation

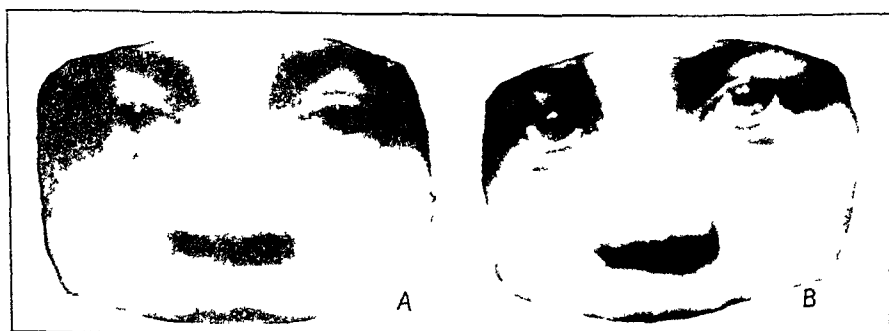


Fig 11 (case 5) — *A*, before operation, *B*, after operation, front view

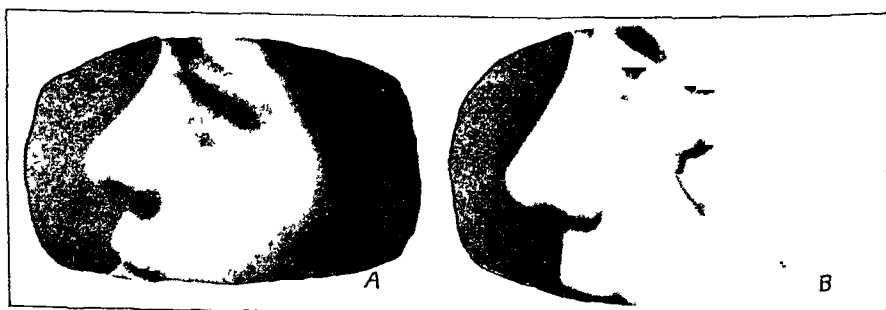


Fig 12 (case 5) — *A*, before operation, *B*, after operation, lateral view

CASE 6 (fig 13)—M M, a medical student, aged 21, sought relief because he was very conscious of his bulky nose and was convinced that it would be an absolute detriment to his future career

He consulted another surgeon who advised insertion of transplant Preliminary work on a plastic model convinced me that removal of tissue and narrowing of the nose, rather than adding to it, were necessary This procedure was then carried out with good results

CASE 7 (fig 14)—K H, a nurse, was operated on, her physical deformity and the postoperative results being shown in figure 14

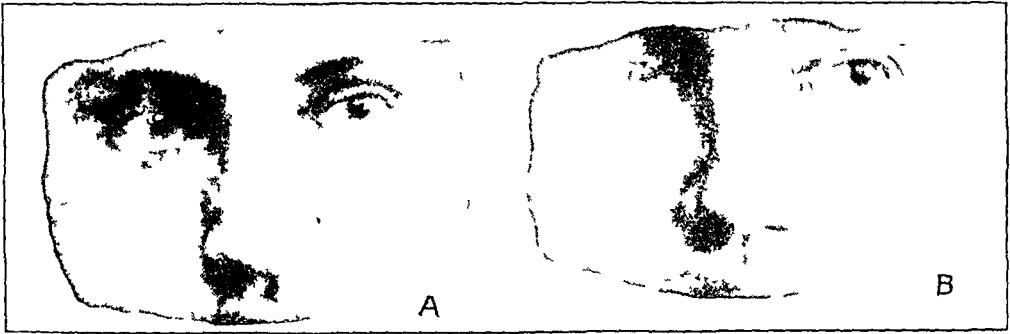


Fig 13 (case 6)—*A*, before operation, *B*, after operation

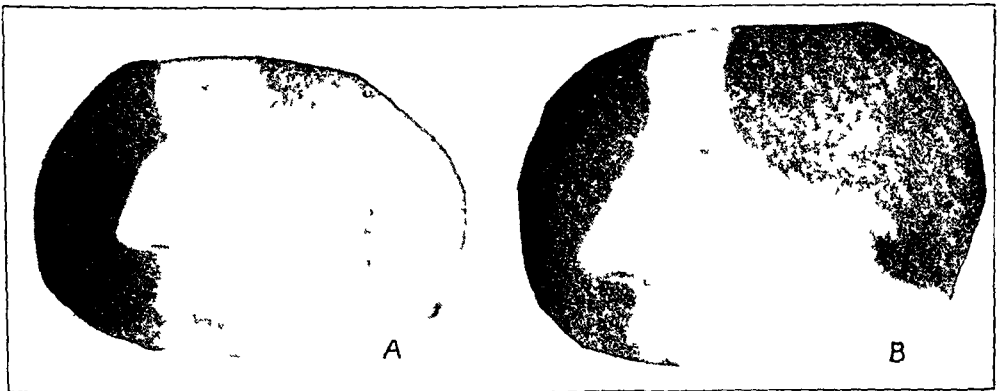


Fig 14 (case 7)—*A*, before operation, *B*, after operation

Even those who do not approve of cosmetic surgery cannot deny that the patients in cases 1, 2, 3, 5 and 7 were entitled to earnest attention and best efforts for relief ¹⁹

Fear of infection scares a good many from this type of work When one makes sure of the absence of either local or systemic disease and then employs aseptic technic, which includes gentle handling of the tissues, the occurrence of infection should be very exceptional ²⁰ When infection occurs, it should be drained immediately through the original point of incision

¹⁹ Smith, Ferris Surgical Treatment of Saddle Nose and Malignancies, J Michigan M Soc 20 414, 1921

²⁰ Cohen, Lee Nasal Deformities, J A M A 67 1663 (Dec 2) 1916

LAWSUITS

In these ultramodern days when patients have recourse to the courts of justice on the slightest provocation, the possibility is well worth bearing in mind in undertaking a surgical procedure, more especially in cosmetic surgery. I know of no foolproof means of evading this unpleasant development. However, having so far managed to avoid courts and even threats of lawsuits, I can offer the following suggestions:

1 Avoid operating in cases of minor nasal deformities. The greater the pathologic process, the better is the chance for a satisfied patient.²¹ Even 75 per cent improvement will be appreciated.

2 Avoid a whiner who projects all his or her misfortunes of life on a slight nasal deformity. A great deal of annoyance will be saved by letting a more ambitious colleague operate.

3 Never operate without a previous photograph. Many a patient forgets what he looked like before an operation.

4 Use a model before operating. When in doubt, additional work on a cadaver will help.

5 Send the patient to a hospital.

6 Be reasonably sure that the patient is not suffering from any local or systemic disease.

7 Do not promise the patient too much. Leave room for pleasant disappointment.

8 Warn the patient that in some instances more than one operation is necessary to secure the best results.

9 It is always safer to do a little less than too much. Many a good result has been sacrificed by too radical surgical measures at the first sitting.

COMMENTS

Unquestionably, cosmetic operations have a decided effect on the functions of the nose in a large number of cases. In most instances, however, the operation is undertaken with a purely decorative purpose. It might readily be argued that the former partake of the nature of necessity, the latter of luxury. It is my insistence that no arbitrary distinction can be drawn between the two, nor can patients be readily classified in either of these categories.

Modern preventive medicine shows an increasing tendency to eradicate most infectious and contagious diseases, simultaneously with an increasing interest in the mental hygiene of the patient. In view

²¹ Blackwell, H. B. Clinical Observation of External Deformities, Laryngoscope **33** 21, 1923.

of the latter development, can the medical profession conscientiously refuse aid to persons suffering from keen mental and spiritual distress as a result of facial disfigurement?

Such persons cannot be lightly dismissed as examples of superficial vanity. Whether male or female (and in my experience the male predominates, incidently), a patient afflicted with a disfigurement has as much moral right to assistance and consideration as one visited with organic disease.

If such is the case, can we as physicians take any other course than to raise the curtain of indifference and incognizance which has for so long concealed the subject of rhinoplasty and bring it into the full light of intelligent understanding? It is incumbent on us to adopt formally what has hitherto been a step-child into our medical family.

CONCLUSIONS

From the foregoing material, the following conclusions are conceivably justifiable:

1 Cosmetic surgery should not be confused with plastic nasal surgery.

2 Correction of nasal deformities is not so complicated as one is led to believe.

3 By aid of a photograph or a plaster of paris model, the work can be definitely planned in advance, an advantage not enjoyed by the surgeon in many other fields.

4 Cosmetic surgery is within the realm of the competent rhinologist. He is familiar with the anatomy, physiology and pathology of the nose. With a fair background of general medicine, he should get the best results.

5 In order to obtain good functional results, in a certain percentage of cases, correction of nasal deformity must be accomplished simultaneously, either before or after eradication of the pathologic process.

6 While it is true that a good many minor deformities are better let alone, there are still a large number of patients who suffer either socially or economically as a result of a nasal deformity. They should receive the same degree of consideration from the serious-minded physician as those afflicted with an organic disease.

7 The medical profession at large must acquaint itself with this problem so as to advise properly its patients. Physicians can then render their patients a service by keeping them out of the hands of unscrupulous persons and at times can prevent disastrous consequences.

ABSTRACT OF DISCUSSION

DR ADALBERT G. BERTMAN, Portland, Ore. I wish to add the intranasal approach to the methods of rhinoplasty named by Dr. Wolf. I use this method almost exclusively, placing at once a silk suture on each edge of the incision and allowing the weight of attached hemostats to retract the edges. This practically brings the incision outside of the nose. I should also like to add the following facts. Patients with great deformity are grateful for any improvement, those with small defects may also be satisfied, provided they are not psychoneurotic and that they know what they want. Patients who have no definite type of nose in mind which they wish to have reproduced are often difficult to deal with, while those who know what the defect is and what kind of a nose they want are more easily pleased. Patients should be told what to expect, what can be done and what cannot be done. A person who is led to expect too much is sure to be disappointed. When multiple operations are required the patient should be so informed. They do not object to step procedures when the matter is explained to them in advance. Any procedure which makes for the mental or physical well-being of the patient is justifiable. It is important, before doing a reconstructive operation on any patient, that photographs be taken, and when possible, plaster or wax casts made. When this is done, no patient can deny his former condition nor question the improvement. The development of reconstructive surgery is following the usual course. First the gross deformities are corrected and later the minor lesions. The advisability of removing small defects is daily more appreciated by physicians and patients. A patient handicapped by a deformity, small when viewed by some one else but great to its possessor, is entitled to the relief that good surgical practice can give. These patients are very grateful. They are restored to their normal psychologic relations to society. Often their social position and economic welfare depend on their appearance. Corrective surgery—call it plastic, cosmetic, reconstructive, or what not—is ethical, and if qualified men do not take it up, unqualified men will. It is scientific, and it not infrequently lifts a great psychologic burden from the individual. Rhinoplasty is not difficult for the surgeon who can visualize the defect and the end-result.

DR. FREDERICK A. FIGI, Rochester, Minn. The term "cosmetic nasal surgery" is distasteful to a number of members of the medical profession and also to many plastic surgeons. I think most of us interested in rhinoplasty much prefer the term "plastic" surgery or "reconstructive" surgery of the nose, because the type of work implied by these terms has greater justification and a wider field of usefulness than purely cosmetic nasal surgery. The patient who applies for reconstructive nasal surgery does so because he has a real deformity the correction of which is necessitated by both social and business relations. The patient who applies for what might be termed cosmetic surgery does so more for the gratification of pride. The man or woman who has lost all or a portion of the nose as a result of trauma of any kind is not only a social outcast, but is placed at serious disadvantage in business dealings. The same is true to a less extent of the patient with a saddle-back nasal deformity, which to the lay mind commonly indicates syphilis. In fact, any outstanding nasal deformity may produce real or imaginary handicap, and if it does its correction is justifiable. However, to what extent we are justified in correcting many of the minor nasal defects is questionable.

DR. J. D. LEWIS, Santa Barbara, Calif. The essayist has not presented many points for discussion, nor can I see that he has suggested any new technical methods or improvements of those now followed, therefore, there is little to say

With reference to approaching the dorsum of the nose, he mentions the intranasal method. In the August, 1922, issue of the *Laryngoscope*, I described a method by which the nasal dorsum is approached externally through a vertical incision made in the column of the nose, the opening being enlarged by undermining of the nasal tip. Through this small incision it is very easy to perform almost all operations for the correction of dorsal deformities, e. g., the removal of humps or the introduction of prosthetic material for the correction of saddle-nose. The method has several distinct advantages over the intranasal route, namely, the field of operation is amenable to sterilization, the operative technic is greatly simplified, and the resultant scar is invisible. Later the method was modified in this particular (*Laryngoscope*, August, 1924). When prosthetic material is to be introduced into the dorsal tunnel, it is generally advisable to divide the procedure into two stages. First, the tunnel is made and a period of four days allowed to elapse before introducing a prosthesis. This allows time for the lymph drainage and blood supply to readjust themselves and for an exudate to form and clothe the surfaces of the tunnel. This modification obviates postoperative reaction, renders the danger of infection negligible and facilitates the introduction of prosthetic material. While infections following intranasal methods employed in the correction of nasal deformities are not common, when they do occur, the results are often disastrous. All surgeons know that it is the occasional infection that always threatens—a thing we are constantly striving to prevent.

PERITRACHEAL ABSCESS

LYMAN RICHARDS, M D

BOSTON

Acute infections of the mediastinum have long been recognized as grave surgical conditions offering little hope of recovery even in the face of drastic efforts at treatment. Further consideration of this group of cases, however, indicates that there is a finer classification depending on the location of the focus of entrance of the infection, the extent or lack of localization and the etiology of the infection itself. So-called acute mediastinitis, a fulminating, spreading and unlimited infection is indeed an almost hopeless affair, but a mediastinal abscess, walled off and capable of some surgical approach for drainage, is by no means so discouraging. The former is usually traumatic in origin, such as may follow instrumentation of the esophagus, perforation of the esophagus or trachea by gun shot, or any other sudden entrance of infection into the mediastinal tissues. A mediastinal abscess, on the other hand, may result from an extension of an infection in an adjacent region, such as a periesophageal abscess, a retropharyngeal abscess or an abscess in the neck which has extended downward. Galen has recorded instances of such mediastinal abscesses, some of which must be classified as idiopathic in origin.

Hare, in 1888, recorded 115 cases of abscesses of the mediastinum, including three infants, in one of whom the infection was treated by opening an abscess in the neck. Lerche up to 1907, could find only 8 cases in which the suppuration originated in the neck and extended downward into the mediastinum. These were treated by drainage via the cervical route, in contradistinction to the other methods of approaching the mediastinum lower down through the back or by removal of portions of the sternum. In Abt's "System of Pediatrics" is mentioned the burrowing of pus in the groove between the trachea and esophagus.

Thus it appears that there exists a surgical condition in which infections of the neck may extend downward into the superior mediastinum without producing so serious and acute a condition as to defy any except the most drastic surgical measures. The symptoms of such a condition are, aside from the usual manifestations of sepsis, some degree of pressure on the upper respiratory tract and on the esophagus itself, with resultant dyspnea and dysphagia. Hence, surgical drainage is indicated, both in order to terminate the infection and to relieve respiratory obstruction and the inability to partake of food.

* Submitted for publication, Nov 18, 1929

* Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929

From an anatomic point of view, such abscesses are more common in the anterior than in the posterior mediastinum. They may point externally in various places, such as the supraclavicular fossa, ulcerate into the trachea or esophagus or extend downward toward the diaphragm. The prognosis is better when they point externally, though at times even when undrained they have remained localized and become chronic.

Such a localized mediastinal infection must be differentiated from an encapsulated empyema, an abscess of the lung or an infection of the thymus gland. In 100 necropsies performed at an army camp, 11 substernal pockets of pus were discovered. Such pockets, however, were not all in the mediastinum, in a few instances they were found to be in the pleural cavity as a localized empyema.

Because of the occurrence of just this problem in diagnosis in an infant aged 1 year, I shall present the features of the following case.

REPORT OF CASE

The patient was admitted to the Children's Hospital in Boston, Jan 14, 1929, the complaint being dyspnea of four days' duration. The onset of the illness was six weeks previously, and was marked by a nasal discharge, cough, rapid respirations and a temperature of 104 F. This continued for two weeks and the condition was thought to be a bronchopneumonia. There was some improvement, but the fever continued, and there was a loss in weight. Four days before entrance, all symptoms became aggravated, particularly by labored breathing, refusal of all food and general prostration.

On admission the child appeared acutely ill, prostrated and dehydrated, with rapid, deep and labored breathing. There was an expiratory crow, and soft, inspiratory stridor suggestive of laryngeal obstruction. At this time there was no suggestion of any glandular swelling about the neck. A report of the results of direct examination of the larynx was as follows:

"There is a considerable edematous swelling of both arytenoids. The vocal cords do not look abnormal. There is no membrane and the glottic space below the cords looks adequate. The appearance is that of any early streptococcus inflammation involving the glottic rim. This may quiet down under conservative treatment by inhalations and expectorants. I should advise intubation if dyspnea increases."

This opinion was in accordance with the views expressed at the last meeting of the American Bronchoscopic Society that in such cases of streptococcus laryngitis, intubation might be preferable to tracheotomy. The roentgen report on admission was that of a localized collection of fluid in the apex of the right lung, but the patient was dyspneic and stridorous out of all proportion to the observations in the chest.

The question of treatment was the immediate concern. For some time previously it had been the intention to place the next patient with acute laryngeal infection in the so-called "oxygen tent." This apparatus was designed to provide better oxygenation for patients acutely ill with pneumonia and as such has proved its life-saving value over and over again. It was felt that if acute laryngitis, like acute tonsillitis, was a somewhat self-limited infection, the patient could be tided over this period of dyspnea and aided in breathing by an increased supply of oxygen,

until such time as the laryngeal edema subsided. In this way it was hoped to avoid either tracheotomy or intubation. For the succeeding twenty-four hours the infant was much more comfortable in the tent, and there was a marked difference in respiration inside and outside the apparatus. The next day, however, the patient was restless and did not take food well. Two days later, with the infant still in the tent, dyspnea and stridor were increased, with marked retraction of the chest wall.

Tracheotomy was urged by the pediatric staff and seemed an absolute necessity in such a situation. The operation is recorded as follows:

"Incision over the trachea. On dividing the pretracheal muscles there was a sudden gush of thick yellow pus from the left side of the trachea. There had been no evidence of swelling over the trachea which was palpable under the skin. There was a cavity of uncertain size extending posteriorly, apparently behind the trachea.

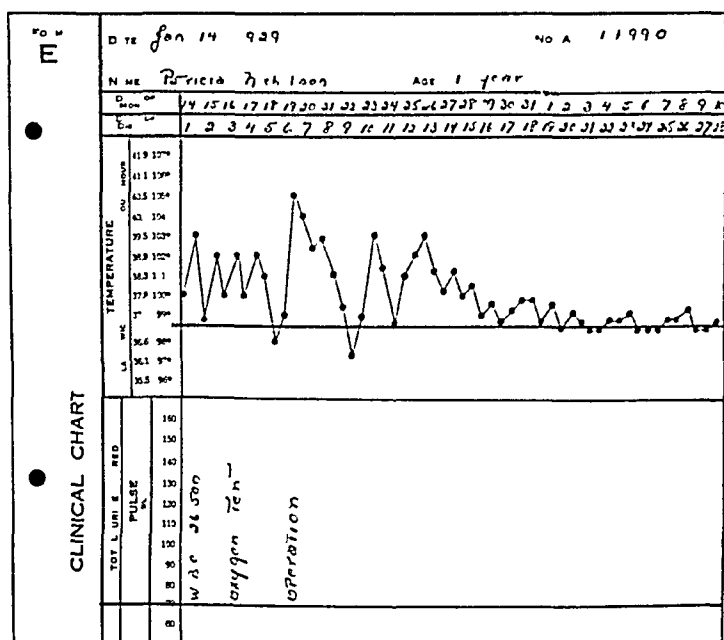


Fig 1—Temperature chart indicating the general course of the disease before and after operation

This was packed with iodoform gauze. The trachea was not opened, as it was felt that the dyspnea had been due to the pressure of this abscess and that there was no essential laryngeal obstruction. A culture of the pus showed a hemolytic streptococcus."

The subsequent convalescence is indicated by the temperature chart shown in figure 1. There were several stormy days immediately after the operation during which there was irregular fever, but less dyspnea, with apparently a good deal of benefit from the oxygen tent in which the infant was kept for several days more. The greatest difficulty was in feeding the patient who still suffered markedly from dysphagia, a symptom now attributed to the general swelling in the tissues of the neck with pressure on the esophagus. Gavaging was necessary for more than a week later, a situation which led to a surgical consultation as to whether this dysphagia might be due to a deeper mediastinal infection, still undrained. Clyses and two transfusions were resorted to in the meantime.

COMMENT

Figure 2 represents two x-ray films. The first is that of the chest condition shortly after entrance. Here will be noted the sharply delineated shadow diagnosed as fluid in the right upper part of the chest. Next to this is a picture of the chest six days after the incision of the abscess in the neck. While there is no proof of the direct relationship of cause and effect, it is natural to conclude that drainage of the abscess had some connection with the rapid disappearance of the x-ray shadow in the apex of the right lung. If there was a direct connection, then the collection of fluid seen by roentgen examination may well be regarded as lying in the superior mediastinum into which it had extended from the neck, with the resulting bulging of the right mediastinal wall to the right. On the other hand, the mediastinal infection



Fig 2—The chest before and after operation. *A* shows the sharply demarcated collection of fluid in the apex of the right lung. *B*, the rapid resolution in this region after incision of the peritracheal abscess.

may have originated in this region, with some periesophageal infection as the starting point and then burrowed its way upward and to the left, to point finally at the spot on the left side of the trachea where it was drained. The location of the drainage point on the left and the x-ray shadow on the right would be more puzzling were it not that a similar crossing of pus behind the trachea was noted by Lerche in an experiment mentioned later.

If, however, the x-ray shadow denoted a localized empyema following the evident pneumonia, there are two conditions to explain—the empyema and the peritracheal abscess. Moreover, there is no particular reason why an encapsulated empyema should disappear after drainage of the cervical abscess. During the days of convalescence when dysphagia was so marked, the surgical staff was greatly tempted to explore this

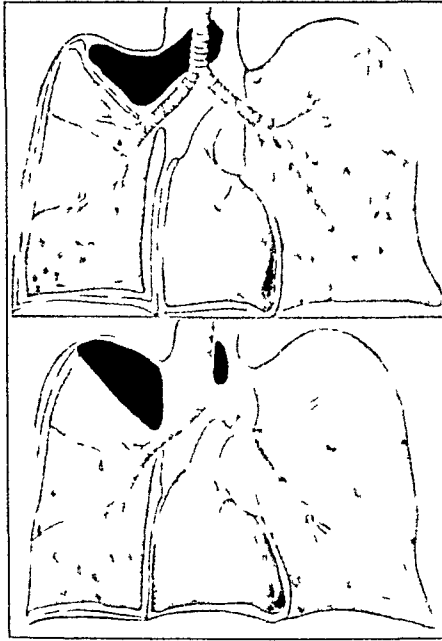


Fig 3—Two schematic drawings showing the possible locations of the abscess. Above, a mediastinal abscess continuous with the peritracheal abscess, below, an encapsulated apical empyema entirely distinct from the peritracheal abscess.

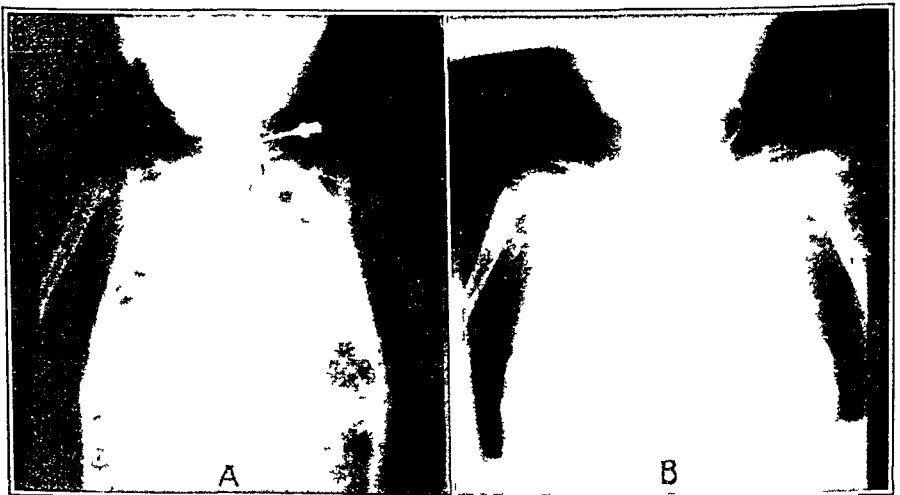


Fig 4—Injections of iodized oil in a cadaver. *A*, initial injection of the oil in the region of the peritracheal abscess, *B*, further injection of more oil made to ascertain if there was any tendency for the oil to pass behind the trachea into the region of the apex of the right lung.

collection of fluid with a needle and even considered an external operation, but fortunately refrained until this collection of fluid vanished following the drainage of the abscess

One more possibility remains to be considered, namely, that of an encapsulated empyema which, like the empyema necessitatis, burrowed its way into the neck

In figure 3 are shown highly schematic drawings of the two possibilities (1) an encapsulated empyema and a cervical abscess, and (2) a mediastinal infection with cervical extension, either of these would give essentially the same appearances in a roentgenogram. An empyema burrowing into the neck would likewise show a film of similar appearance

In an effort to throw further light on the problem of this differential diagnosis, I procured a recent infant cadaver and injected iodized poppy-seed oil 40 per cent into the exact region in the neck where the pus was evacuated at the time of operation. The results are shown in figure 4. I then made a further injection from this same point with added force in the hope of discovering that there was a tendency for the oil to extend downward and perhaps to the right in the mediastinal tissues. In this I was disappointed, as the increased pressure only resulted in a diffusion of the opaque material around the initial point of injection

I had thought that this simple experiment might have an element of originality about it, but I was not surprised to find in my first bibliographic reference that Leiche had already injected barium sulphate in buttermilk into the upper part of the groove between the trachea and the esophagus. He said that with gradually increasing force the mass was found to extend laterally along the esophagus and trachea into the superior mediastinum, when greater force was used, it crossed in front of the trachea to the opposite side. This crossing is important in view of the observation in the present case, although here there was no sign of an infection anterior to the trachea

The patient finally made a complete convalescence. The abscess cavity, which was never probed, filled in and healed without further symptoms

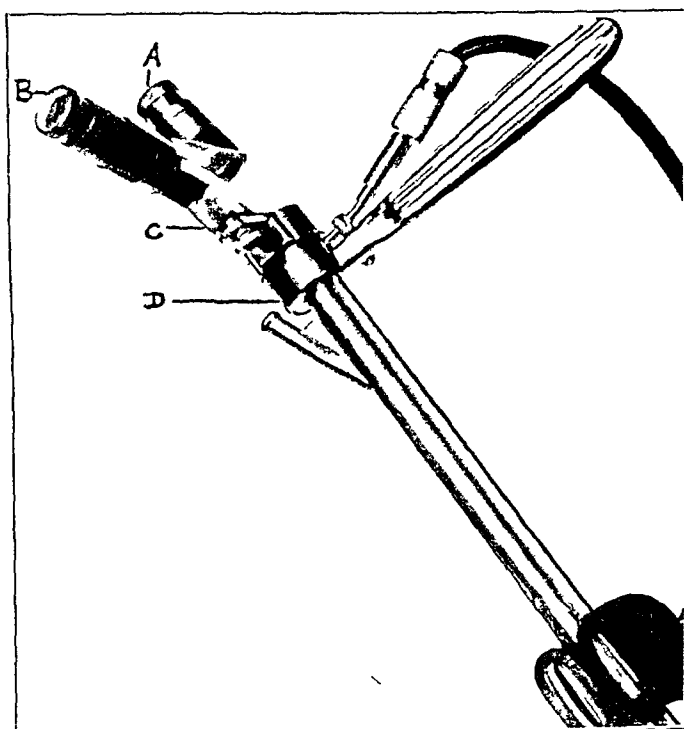
I have entitled this report "Peritracheal Abscess" as the case still admits of some doubt as to whether it was a true mediastinal abscess

Clinical Notes

DEMONSTRATING BRONCHO-ESOPHAGOSCOPE

CHARLES J. IMPIRATORI, M.D., NEW YORK

This device consists in a two vision telescopic attachment for the Jackson type of bronchoscope and esophagoscope. The direct telescopic view is obtained by the operator by attaching the device to the proximal end of the bronchoscope or esophagoscope after the usual introduction of the endoscope. An individual focusing arrangement for the operator and the observer is provided.



A is the operator's eyepiece, *B*, the observer's eyepiece, *C*, the prism, and *D*, the bronchoscope

There is no magnification, distortion or inversion of the image. The operator has a direct view of the field, while the observer's view is through a prism. A collar on the attaching mechanism permits the observing telescope to be turned to either the right or the left of the operator. In teaching and demonstrating, the value of this attachment is obvious.

Mr. Reinhold Wappler, of the American Cystoscope Makers, Inc., made this instrument for me.

17 East Thirty-Eighth Street

Submitted for publication, Nov 18, 1929

Read at the Twelfth Annual Meeting of the American Bronchoscopic Society, San Francisco, July 6, 1929

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

PERORAL ENDOSCOPY ¹

LOUIS H CLERF, M D
PHILADELPHIA

General interest in bronchoscopy and esophagoscopy, more widespread application of these measures as a means of diagnosis and of treatment and an increasing desire on the part of laryngologists to perfect themselves in the technical knowledge so necessary to employ these methods safely have done much to contribute to the sum total of the knowledge concerning diseases of certain organs and structures. Among the outstanding contributions for the current year in the field of peroral endoscopy are certain observations on peptic ulcer of the esophagus. These were made possible only by the data secured by direct inspection of the interior of the esophagus by esophagoscopy.

Chevalier Jackson ¹ expressed his belief that when the time shall have come that every patient with the slightest discomfort or abnormality in swallowing, every patient with pain or discomfort back of the sternum, every patient with gastric hematemesis, every patient with regurgitation, "heartburn" or "waterbrash" is examined esophagoscopically, peptic ulcer of the esophagus will be found less rare than it is now thought to be, though it is probably not a common disease.

Jackson reported eighty-eight cases of peptic ulcer, of these twenty-one were active ulcers and sixty-seven were scars probably due to preceding peptic ulcers. The etiology, symptomatology and diagnosis were discussed. The chief characteristics of the esophagoscopic appearance were the flatness of the lesion, the absence of annular infiltration of the esophageal wall and the absence of exuberant fungations. In the early stages, these characters were well marked, later, the edges became somewhat raised, and still later, slightly undercut. In no instance were there found the fungations commonly seen in cancerous ulcerations. There was usually a zone of contrasting intense hyperemia around the edge of the ulcer. The lesions commonly were single. In most cases, the ulcer was elongated, in five, it was round.

¹ Submitted for publication, Jan 30, 1930

¹ Jackson, Chevalier. Peptic Ulcer of the Esophagus, J A M A 92
369 (Feb 2) 1929

Jackson concluded that deductions from eighty-eight cases of peptic ulcer of the esophagus suggest focal infection as the chief etiologic factor with the tonsil as the most frequent site of the focus. Islands of gastric mucosa are accessory causes. Retrograde flow of gastric juice may or may not be a perpetuating etiologic factor, but it is certainly a cause of the pain. The most characteristic symptom of peptic ulcer of the esophagus is retrosternal pain or discomfort extending through to the back. Chronic esophagitis is accompanied by the same symptoms, but they are less severe. Ulcer may be symptomless.

Esophagoscopy for diagnosis is indicated in every patient complaining of the slightest abnormality in swallowing or the slightest degree of retrosternal pain or discomfort.

The best treatment for peptic ulcer is by eradication of focal infection, plus the local esophagoscopy application of argentic nitrate, or bismuth subnitrate. Palliative control of the symptom, pain or discomfort is afforded by alkalis, especially sodium bicarbonate. Opiates are unnecessary and are contraindicated.

In discussing the etiology of peptic ulcer of the esophagus, Friedenwald² and his associates expressed their belief that it is necessary that the cardia remain patent, so that regurgitated acid gastric juice may continue its corrosive effect on the localized diseased area in the esophageal mucous membrane. Dysphagia and substernal discomfort were present in every case observed. Pain was a constant symptom occurring in eleven of the thirteen cases. They observed that pain is always increased during the act of deglutition, a sign that distinguishes it from gastric ulcer. The writers concluded that although peptic ulcers of the esophagus are rare, they occur sufficiently often to be of clinical interest. They are usually observed in the lower third of the esophagus though occasionally they are located higher. These ulcers vary greatly in size and are usually single, the right posterolateral wall is most frequently involved. They resemble in many respects ulcers of the stomach and duodenum. Perforations are not uncommon. In large ulcerations, contraction takes place with the formation of stenosis and dilatation. In the small superficial ulcerations, healing is usual and the esophageal lesion is apt to be overlooked. Ulcerations of the esophagus have been most frequently observed in adults, more commonly between the thirtieth and seventieth years, and are found equally divided between males and females.

The most prominent symptoms of the disease are pain, dysphagia, vomiting, hemorrhage and perforation. There is often great difficulty in arriving at a diagnosis, however, this may be greatly aided by means

² Friedenwald, J., Feldman, M., and Zinn, W. F. Peptic Ulcer of the Esophagus, *Am J M Sc* **177** 1 (Jan) 1929.

of fluoroscopy and esophagoscopy. The treatment consists in the eradication of foci of infection, next, the regulation of the diet and the administration of olive oil, alkalis and belladonna and at times by the direct application to the diseased area of various remedies such as a solution of nitrate of silver through the esophagoscope. If healing does not occur following this plan of treatment, gastrostomy should be performed to insure adequate feeding and the esophagus kept at rest for a considerable period of time.

VARIOUS CONDITIONS OF THE ESOPHAGUS

Lupus of the Esophagus—This condition is rare, and Forbes'³ case undoubtedly is an outstanding one. The patient, a woman, aged 32, had previously received treatment for lupus lesions on the nose, nasal septum and soft palate. She was sent to Forbes because of dysphagia for solid food. At esophagoscopy, there was found a contraction of the esophageal lumen, beginning at a point 20 cm. from the upper teeth and extending downward for a distance of 3 or 4 cm., apparently due to an ulceration along the posterior and left lateral wall. The lesion was practically healed but presented the typical textbook appearance, consisting of minute pinkish-yellow nodules, the so-called "apple jelly" nodules. Some were broken down, but these were few as compared with those in the healed areas. By esophagoscopy, the strictured area was dilated so that an 11 mm. esophagoscope could be passed beyond the lesion. At this point the mucous membrane appeared normal. The patient's condition was greatly improved, and there was no further difficulty with swallowing.

Varix of the Esophagus—Although esophageal varices are the most common cause of hematemesis in splenic anemia, Moyer'⁴ agreed that they must always be considered as a potential source of hemorrhage into the gastro-intestinal tract. Esophagoscopy is necessary to demonstrate their presence and to determine the size of the veins, the extent of the area involved and the existence of ulceration and hemorrhage. At the time of esophagoscopy there may be no positive proof that the bleeding occurred from the varices but it should be recalled that in a copious hemorrhage the bleeding point may appear small and inconspicuous. Two cases of varices of the esophagus are reported. Hemorrhages persisted after splenectomy, and at esophagoscopy there were found, in each case, marked venous varicosities in the lower thoracic

³ Forbes, H. H. L. Lupus of the Esophagus, Arch. Otolaryng. 9:441 (April) 1929.

⁴ Moyer, J. S. Esophagoscopy Study of Esophageal Varices. Report of Two Cases of Esophageal Varices Persisting After Splenectomy. Arch. Otolaryng. 10:409 (Oct.) 1929.

and the abdominal esophagus. The esophagoscopy observations are important to the surgeon in determining the form of treatment to be employed. If no varices are found at esophagoscopy, the more probable source of the hemorrhage is the veins about the stomach and duodenum.

Pulsion Diverticulum of the Esophagus—In reporting a number of cases of pulsion diverticulum of the esophagus, Sturgeon⁵ reviewed the various theories held concerning etiology and discussed the question of diagnosis. Although the recognition of a diverticulum is not difficult if the esophagus is studied roentgenologically with an opaque mixture, he agreed with the views of esophagoscopists generally, that the diagnosis is never complete without an esophagoscopy examination. This will demonstrate or rule out other pathologic conditions of the esophagus, such as stricture or cancer.

Since reporting on his method of inverting the pulsion diverticulum through the esophagoscope, Imperatori⁶ studied four additional cases and performed the operation in one instance with unfavorable results. He pointed out the dangers and quoted Jackson's dictum that the esophagus is one of the organs that is most intolerant of trauma, a fact that should always be borne in mind in operations on the esophagus. If this is done, there will be fewer fatalities.

Pouch of the Esophagus—In Mosher's⁷ case, difficulty in swallowing solid food began suddenly and later there was observed a soft swelling on the right side of the neck. By fluoroscopy, the esophagus was found much dilated and filled with air. There was observed on the right a pear-shaped pouch, also filled with air, and extending in the chest as far as the arch of the aorta. At esophagoscopy, the esophagus was readily entered, and at a point 18 cm. from the incisor teeth the opening was found to the left and of good size. To the right the mucous membrane was thrown into folds. Ballooning reduced the folds and disclosed a pouch on the right, the opening of which was easily passed. The lower end of the esophagus was dilated with a Sippy dilator. On returning three months later, the patient stated that she was eating everything. The swelling in the side of the neck had not recurred.

Perforation of the Esophagus—In five of King's⁸ cases the perforation of the esophagus occurred following the swallowing of a

5 Sturgeon, C. T. Esophageal Diverticula, J. A. M. A. **92** 379 (Feb. 2) 1929.

* 6 Imperatori, C. J. Endoscopic Treatment of Pulsion Diverticulum. A Further Report, Arch. Otolaryng. **9** 266 (March) 1929.

7 Mosher, H. P. Pouch of the Esophagus, Arch. Otolaryng. **9** 547 (May) 1929.

8 King, E. Perforation of the Esophagus with Report of Six Cases, Ann. Otol. Rhin. & Laryng. **38** 351 (June) 1929.

foreign body, while in the sixth case it followed blind bouginage. In two, the perforation occurred in the thoracic esophagus, and in four the cervical portion was involved. There was one death. Pain is commonly the first symptom, followed by dysphagia, fever and rapid pulse. Swelling of the tissues and emphysema are often accompanying signs. The roentgen ray is an important aid in the recognition of early emphysema and in determining the progress of the lesion. King expressed his belief that external drainage should be resorted to in certain of these cases.

Esophagoscopists are in agreement that suppurative inflammation of the tissues surrounding the esophagus is a most dreaded complication. Kramer⁹ reported three cases of periesophageal suppuration in which esophagoscopic treatment was successful. The first case represented a mild form of suppuration located within the layers of the esophageal wall. In the second case there was necrosis of the superficial layers of the esophageal wall with extensive suppuration in the deeper layers, probably involving the deep cervical or periesophageal regions, with fairly severe local and systemic symptoms. The third case represented the severest form of infection, namely, mediastinal infection following a laceration of the esophageal wall. The treatment should consist of a diagnostic esophagoscopy to determine the nature of the lesion, to remove any foreign body present and to evacuate the abscess cavity. General supportive measures are necessary, if improvement does not promptly follow, external drainage should be considered.

Cancer of Esophagus—Guns¹⁰ strongly urged the use of the esophagoscope in esophageal disease. He stated that in every case of esophageal dysphagia a roentgen study should be made, followed by esophagoscopy on the basis of these observations. His contention, shared by all esophagoscopists, was that by this routine procedure something can be done toward lowering the mortality rate of cancer of the esophagus.

Congenital Atresia of Esophagus—In Simpson's¹¹ three cases of congenital atresia, the lower end of the esophagus opened into the trachea just above the bifurcation. These cases conform to the type most commonly observed. Gastrostomy was performed as soon as the diagnosis of congenital atresia was made, however, all the patients died of bronchopneumonia.

⁹ Kramer, R. Endoscopic Treatment of Esophageal Suppuration, *Laryngoscope* **39** 97 (Feb) 1929.

¹⁰ Guns, P. Cancer of Esophagus, *Arch d mal de l'app digestif* **19** 420 (April) 1929.

¹¹ Simpson, W. L. Congenital Atresia of the Esophagus with Tracheo-Esophageal Fistula, *Arch Otolaryng* **9** 267 (March) 1929.

The Aorta and Esophagoscopy—Moyer¹² reviewed his observations in three patients with compression stenosis of the esophagus due to aortic disease. In each the condition was atypical. In one case, the stenosis was due to multiple aortic aneurysms, in a second, it resulted from aortic encroachment unassociated with aneurysm, while in a third the aortic compression played a contributory although not the chief part in producing the esophageal symptoms. Moyer concluded that the Jackson progressive high-low position tends to protect the aorta in esophagoscopy. Aneurysm of the aorta is not an absolute contraindication to esophagoscopy for diagnosis. Without special roentgen technic, a condition in the lower part of the thorax that is of interest to the endoscopist may be overlooked in the ordinary anteroposterior film made primarily to determine the condition of the lungs. In studying the esophagus, in addition to the usual oblique and lateral films, it is desirable to have an anteroposterior roentgenogram of the chest in which, so far as is possible, the detail of structures within the cardiac shadow is brought out. An elongated, tortuous, sclerotic aortic arch, in the absence of aneurysmal dilatation, may produce esophageal compression with symptoms. When a foreign body lodges in the esophagus at the site of a stenosis due to aortic pressure, it should be cautiously dealt with by endoscopic means.

BRONCHIOSCOPY IN DIAGNOSIS

In a review of bronchoscopy in its application to the broader field of general medicine, Yankauer¹³ emphasized its value in the diagnosis of diseases of the chest, and set forth certain reasons why this subject should be of particular interest to the general diagnostician. In some cases it affords the only means of making a final and conclusive diagnosis, for instance, it affords the opportunity for a biopsy. Negative bronchoscopic observations, like other negative observations, make possible a diagnosis by exclusion, which is often valuable. Bronchoscopy sometimes succeeds when other means fail, as by making possible a bacteriologic study of the uncontaminated flora of the deeper parts of the lungs, even to the extent of finding tubercle bacilli when repeated examinations of the expectorated sputum have failed to disclose them. Rare and unsuspected conditions, not otherwise recognizable, may be found. In appropriate cases, it becomes possible to institute therapeutic measures at the same time with, and because of, the recognition of the true condition.

12 Moyer, J. S. The Relation of the Aorta to Esophagoscopy, *Arch Otolaryng* 10 447 (Nov.) 1929.

13 Yankauer, S. Bronchoscopic Diagnosis and Treatment of Lung Abscess, *Laryngoscope* 39 215 (April) 1929.

In a general discussion of the advantages of peroral endoscopic measures in diagnosis Beatty¹⁴ enumerated a list of the generally accepted indications for these measures. He emphasized what endoscopists have long believed absolutely necessary, namely, the importance of adequate training before attempting any of these operations, these measures are not dangerous if properly performed.

Obtaining secretion from the tracheobronchial tree of infants and children for bacteriologic study is always a problem since they do not expectorate and invariably swallow secretion coughed into the throat. Goldman¹⁵ found that direct laryngoscopy afforded a satisfactory and simple method of obtaining secretion from the larynx, trachea or bronchi. This method can be quickly carried out without anesthesia and with a minimum of apparatus.

In a review of a number of endoscopic cases, King¹⁶ discussed the benefits of closer cooperation between the bronchoscopist and other departments. He concurred with other observers in the need of careful roentgen studies in all cases of foreign bodies, not only with regard to localization, but also, whenever possible, with regard to the size and shape of the object. His experiences with bronchoscopy in pulmonary abscesses coincided with those of others, and he pleaded for a more general application of this form of treatment.

In directing the attention of the medical profession to the advantages of introducing oxygen directly into the trachea, Guerinot¹⁷ reported his experiences in the treatment of a case of carbon monoxide gas poisoning occurring in an infant, aged 4 days. The child was unconscious. Guerinot introduced a 4 mm bronchoscope into the trachea and piped oxygen directly into the lungs for twenty-five minutes. The child made an uneventful recovery without complications.

NEOPLASMS OF THE BRONCHUS

Fibrolipoma of the Bronchus—To a group of ten cases of bronchial neoplasms which were removed bronchoscopically, Myerson¹⁸ added an additional case in which a large fibrolipoma was removed from the left

14 Beatty, H. G. The Diagnostic Value of Broncho-Esophagoscopic Examinations, *Ohio State M. J.* **25** 634 (Aug.) 1929.

15 Goldman, I. B. Direct Laryngoscopy as a Method for Cultural Studies of Pulmonary Secretions in Infants and in Children. *Am. J. Dis. Child.* **38**:47 (July) 1929.

16 King, E. Bronchoscopy. Its Relation to the Other Departments of the Hospital, *Laryngoscope* **39** 91 (Feb.) 1929.

17 Guerinot, A. J. Bronchoscopy and Esophagoscopy in Infancy, *Laryngoscope* **39** 309 (May) 1929.

18 Myerson, M. C. Benign Neoplasms of the Bronchus. Report of a Case of Bronchoscopic Removal of a Fibrolipoma from the Left Main Bronchus, *Arch. Otolaryng.* **9** 376 (April) 1929.

main bronchus The patient, a man, aged 47, had been ill for eighteen months, during this time, he had been under the care of a number of physicians in a number of hospitals No definite diagnosis was made, although it was believed that he had asthma When he was seen by Myerson, there were physical signs of atelectasis of the left lung At bronchoscopy, a large mass was encountered which filled the left main bronchus Because of the movement of the tumor with respiration it was thought to be pedunculated When removal was attempted at a subsequent bronchoscopy, it was found that the tumor was bilobular and that the posterior lobe was cystic The cyst was ruptured with forceps and thin fluid escaped Air could then enter the left bronchus and the left lung expanded The tumor was completely removed and the patient remained practically free from all symptoms There persisted a moderate bronchiectasis of the left lower lobe This case further emphasizes the necessity of bronchoscopy in obscure conditions of the chest in order to establish a correct diagnosis, and also shows that benign neoplasms of the bronchus can usually be readily removed by bronchoscopic means

Carcinoma of the Bronchus—Burrell¹⁹ reported the case of a man, aged 29, who complained of pain in the chest, cough, dyspnea and blood-stained sputum There was a history of an accident and the breaking of a tooth, it was thought that he might have aspirated the tooth A diagnosis of pulmonary collapse was made from the physical signs and roentgen observations No shadow of a foreign body being visible, a bronchial tumor was suspected A diagnostic bronchoscopy was done, and a red, rounded mass was seen in the right main bronchus At a subsequent bronchoscopy, the growth was found to have a definite pedicle It was completely removed by biting forceps, the point of attachment appeared as a small excoriated area Although the tumor looked like a soft fibroma, the histologic diagnosis was adenocarcinoma

Hajek²⁰ reported a case of a man, aged 74, who complained of dyspnea which could not be accounted for by indirect examination of the pharynx, larynx and upper part of the trachea A tracheoscopy was performed There was found a large tumor springing from the right tracheal wall and partially occluding the orifices of both main bronchi The entire tumor was removed piecemeal, and proved to be a pure fibroma After two years, the patient remained well Another equally interesting case was that of a man, aged 50, who was very dyspneic and hoarse There was found a flat, uneven tumor involving

19 Burrell, L S T Case of Adenocarcinoma of Bronchus, *Lancet* 2 708 (Oct 5) 1929

20 Hajek, M Laryngo-Rhinology and General Medicine, *Laryngoscope* 39 75 (Feb) 1929

the subglottic area of the right side of the larynx. Additional examinations indicated that extensive changes were present in the entire left lung, suggesting either extensive infiltration or atelectasis. Since the laryngeal lesion did not seem to be of sufficient size to account for the dyspnea, it was decided to do a bronchoscopy. A large tumor was found occluding the left main bronchus, it was unquestionably cancer. Necropsy confirmed the clinical diagnosis, the bronchial tumor was the primary growth, and the subglottic area was of metastatic origin.

The necessity of a diagnostic bronchoscopy to determine the cause of bronchial obstruction was again demonstrated by Kernan and Cracovaner,²¹ who reported a case of carcinoma of the left main bronchus which produced an intermittent atelectasis of the lung. The diagnosis was made by bronchoscopy and biopsy. The growth was partially removed at bronchoscopy, radium needles were inserted and surgical diathermy was administered through the bronchoscope. When last examined bronchoscopically, the entire tumor mass was gone. It was replaced by a whitish area suggesting scar tissue. The patient was symptomatically well.

Asthma—In a report on seven patients with asthma who were treated bronchoscopically, Daily and Daily²² corroborated many of the observations made by others concerning the appearances of the tracheo-bronchial mucosa, the collapse of the trachea during cough and expiration and the character of the secretion. They agreed that bronchoscopy is positively indicated in cases of asthma when all other means of investigation have failed to establish a correct diagnosis and when relief from symptoms cannot be obtained by the usual measures.

PULMONARY ABSCESS

The report by Flick²³ and his associates is important, as it includes an analysis of a large group of cases. It is of particular value because it represents the ultimate results of combined effort, namely the close cooperation of the internist, roentgenologist, bronchoscopist and surgeon. Data bearing on the sites of the abscesses and the ages of the patients are noteworthy. Considerable importance is attached to the rôle that bronchoscopy plays not only in diagnosis but also in treatment, in fact, practically 80 per cent of the patients accepted for treatment were first referred to the bronchoscopist.

21 Kernan, J. D. and Cracovaner, A. J. Carcinoma of the Lung. *Arch Surg* **19** 315 (Jan) 1929.

22 Daily, L., and Daily, R. K. The Value of Bronchoscopy in the Diagnosis and Treatment of Asthma. *Laryngoscope* **39** 304 (May) 1929.

23 Flick, J. B., Clerf, L. H., Funk, E. H., and Farrell, J. T. Jr. Pulmonary Abscess. An Analysis of One Hundred and Seventy-Two Cases. *Arch Surg* **19** 1292 (Dec) 1929.

The writers concluded that the diagnosis and treatment of abscess of the lung require the close cooperation of internist, roentgenologist, bronchoscopist and surgeon. The prognosis in a given case is often favorably influenced by the teamwork of this group. A diagnostic bronchoscopy should be done in all cases of pulmonary abscess irrespective of the method of treatment to be employed. The *sine qua non* in treatment is the establishment of adequate drainage. This may be accomplished in many cases by conservative measures which include bronchoscopic aspiration. The indications for surgical treatment have been outlined. Conservative treatment should not be continued too long if distinct benefit is not obtained since complications occur which increase the risk and decrease the chances of recovery with surgical intervention.

Johnson²⁴ reported remarkable results in a series of four cases of pulmonary abscess following bronchoscopic treatment. In three instances, the patients were so critically ill when the first bronchoscopy was performed that the question arose as to the advisability of carrying out the procedure. In every case there was striking improvement following a single bronchoscopic aspiration.

In discussing the treatment for pulmonary abscess, Gutteridge²⁵ agreed that bronchoscopy should be instituted early, in fact, as soon as the diagnosis is completed. He emphasized the importance of general medical measures and concurred that the best results are obtained by the close cooperation of physician, surgeon, bronchoscopist and roentgenologist under the general supervision of the physician.

Martin²⁶ discussed the value of bronchoscopy and its application to general medical diagnosis and treatment. The question of foreign bodies was briefly discussed and several case reports of bronchial foreign body were presented to emphasize the importance of diagnostic bronchoscopy when obscure signs and symptoms are present in the chest even if no history of a foreign body can be elicited. Martin has had satisfactory results in the treatment for bronchiectasis by bronchoscopic lavage of the bronchiectatic area with a weak boric solution. In the treatment for asthma by vaccine therapy he corroborated the observation that these patients are benefited by an autogenous vaccine made from bronchoscopically removed secretion, whereas there was no response to vaccine made from sputum.

24 Johnson, L. F. Bronchoscopy in Acute Lung Abscess, *New England J Med* **200** 64 (Jan 10) 1929.

25 Gutteridge, E. Suppurative Diseases of the Lungs from the Bronchoscopic Standpoint, *M J Australia* **2** 260 (Aug 24) 1929.

26 Martin, G. E. The Bronchoscopic Diagnosis and Treatment of Bronchiectasis and Other Chronic Non-Tuberculous Diseases of the Chest, *Edinburgh M J* **36** 153 (Aug) 1929.

EXPERIMENTAL INVESTIGATIONS CONCERNING THE ETIOLOGY
OF PULMONARY ABSCESS

With the production of an extensive literature on the experimental and clinical studies carried out to determine the etiology of pulmonary abscess, the question of the advisability of reviewing this has arisen. Too often an abstract is inadequate to set forth sufficient of the important details. It is therefore believed that brief reference to these studies should be made by simply setting forth the problems and the ultimate conclusions.

Lambert and Weeks²⁷ made no attempt to ascertain whether abscess of the lung is of embolic or aspiratory origin, their studies were carried out purely from a bacterial standpoint. They employed the embolic method of abscess production, believing that the chances for infection were less by this method than by the peroral method. They found that anaerobes associated with pulmonary abscess in man are pathogenic for dogs. Single discrete pulmonary abscesses may be caused in dogs by employing anaerobes alone in a blood clot. They expressed the belief that anaerobes are not simply secondary invaders but can and do cause suppuration of the lungs.

The occurrence of a suppurative pneumonitis and extrabronchial abscess as a complication of tonsillectomy with the later development of a bronchiectatic abscess as reported by Aschner, suggested itself as a problem for investigation to Harkavy.²⁸ The studies were carried out by introducing bronchoscopically in dogs mixed cultures of bacteria recovered from patients suffering with abscess of the lung complicating tonsillectomy. Harkavy expressed the belief that the greater amount of evidence is in favor of aspiration as the mode of production of suppuration of the lung following operations on the upper respiratory tract. He was unable to reproduce bronchiectatic abscesses in dogs, although suppurative pneumonitis and extrabronchial abscess occurred. If the sequence of events occurring in the dog may be applied to that occurring in man, he suggested that following aspiration of infectious material from the upper respiratory tract the probable outcome is as follows: pneumonitis, necrosis and cavity formation, and then healing or persistence of the primary abscess with the formation of secondary bronchiectasis.

Scarff²⁹ was unable to produce a pulmonary abscess in over fifty experiments carried out by bronchoscopic and by transpleural methods.

27 Lambert, A. V. S., and Weeks, C. Experimental Production of Abscess of the Lung, *Arch. Surg.* **18** 516 (Jan.) 1929.

28 Harkavy, J. The Pathogenesis of Aspiratory Abscess of the Lung: Its Possible Relation to Abscess of the Lung Following Tonsillectomy. *Arch. Int. Med.* **43** 767 (June) 1929.

29 Scarff, J. E. Experimental Production of Pulmonary Abscess: Etiologic Factors, *Arch. Surg.* **18** 1960 (June) 1929.

He then infected the frontal sinuses in a series of eight dogs, and later introduced a small pledget of cotton, inoculated with pus from the sinus, into a secondary bronchus. The production of pulmonary abscesses in five of the eight dogs indicated that the chronic sinus infection in some way contributes to the formation of the abscess. He stated his belief that bronchial obstruction was essential in the production of abscess in the dog, irrespective of the organisms introduced.

Being unable to explain adequately the etiology of a large group of postoperative abscesses of the lung either by embolic or by bronchogenic inoculation acting alone, Van Allen and others³⁰ tested experimentally the effect of a combination of these two avenues of inoculation of the lung. They found that embolic abscesses of the lung could be enhanced in virulence and chronicity by insufflation of infectious material into the bronchus. They expressed their belief that this combined inoculation may explain the pathogenesis of the obscure group of postoperative pulmonary abscesses.

In another article the same authors³¹ directed attention to the facts that abscess develops much more readily from emboli than from intra-bronchial inoculation of the lung, and that the lung appears to be, in general, much more resistant to necrosis and suppuration than are other tissues. From their experimental studies, they concluded that the following proposition is correct, namely, that the greater vitality of the lung in pyogenic infections is due mainly to a greater blood supply, and that elimination of the pulmonary circulation, as by embolism, reduces the blood supply and tissue vitality to the common level.

PULMONARY ATELECTASIS

The outstanding contribution to the subject of atelectasis of the lung is Bowen's³² article. As stated by the writer, his "paper exploits no new facts. It is simply an attempt to dust off, rehabilitate and show the value of paraphernalia that most clinicians have cast into a neglected corner." The subject is well presented and should be read not only by those who are interested in pulmonary atelectasis but also by those who do not have a clear conception of this remarkable phenomenon. A complete bibliography of the entire subject is given.

30 Van Allen, C. M., Adams, W. E., and Hrdina, L. S. Bronchogenic Contamination of Embolic Abscess of the Lungs, *Arch. Surg.* **19**: 1262 (Dec.) 1929.

31 Van Allen, C. M., Adams, W. E., and Hrdina, L. S. Embolism in Bronchogenic Infection of the Lung, *Arch. Surg.* **19**: 1279 (Dec.) 1929.

32 Bowen, D. R. Acute Massive Collapse (Atelectasis) of the Lung, *Am. J. Roentgenol.* **21**: 101 (Feb.) 1929.

Additional evidence has been furnished by Lee and his co-workers³³ to corroborate their previous studies, namely, that pulmonary atelectasis can be experimentally produced if a bronchus is completely occluded by material removed bronchoscopically from a patient with atelectasis or by the use of some synthetic preparation. The most important criterion in this work is abolition of the cough reflex. In their earlier experiments performed on dogs, the cough reflex could not be satisfactorily controlled, and the results were unsatisfactory. The intraperitoneal introduction of sodium iso-amyl ethyl barbiturate has produced ideal conditions associated with absolute abolition of the cough reflex. This evidence, they stated, is of especial significance, both experimentally and clinically.

In conjunction with their studies of postoperative pulmonary atelectasis, Coryllos and Birnbaum³⁴ carried out extensive experimental studies to prove that lobar pneumonia must be considered as a variety of obstructive atelectasis of the lung. Considerable experimental data were furnished and the question was thoroughly presented from the standpoint of etiology, pathogenesis and pathology, clinical evolution, roentgen observation and diagnosis. In conclusion, they considered lobar pneumonia as an "infectious (generally pneumococcic) lobar atelectasis of the lung," and bronchopneumonia as an infectious patchy atelectasis. They showed that postoperative massive atelectasis, postoperative pneumonia and "lobar pneumonia" have a similar pathogenesis and evolution, and similar clinical and roentgen signs. Bronchoscopic treatment, which has given encouraging results in massive atelectasis, has been suggested and applied to cases of lobar pneumonia in man. The number of these cases is, however, too small to allow definite conclusions to be drawn from them.

On the basis of experimental and clinical studies, Coryllos³⁵ was convinced that postoperative atelectasis and postoperative pneumonia represent two phases of the same pathologic process. He stated the belief that the pneumonia may follow the atelectasis. The dominant factor in the postoperative condition of the lung is bronchial obstruction and impairment of the free bronchial drainage. The fate of the parenchyma of the lung after bronchial obstruction depends on the bacteria in the obstructing mucus. A nonvirulent type IV pneumococcus will produce atelectasis, a more virulent organism, pneumonia,

33 Lee, W. E., Tucker, G., Ravdin, I. S., and Pendergrass, E. Experimental Atelectasis, *Arch Surg* **18** 242 (Jan) 1929.

34 Coryllos, P. N., and Birnbaum, G. L. Lobar Pneumonia Considered as Pneumococcic Lobar Atelectasis of the Lung. Bronchoscopic Investigation, *Arch Surg* **18** 190 (Jan) 1929.

35 Coryllos, P. N. Postoperative Apneumatoxis (Atelectasis) and Postoperative Pneumonia, *J. A. M. A.* **93** 98 (July 13) 1929.

and pyogenic and anaerobic organisms, pulmonary suppuration or gangrene

Anatomy of the Tracheobronchial Tree—Davis'³⁶ studies of the variations of the normal tracheobronchial tree are of particular interest to bronchoscopists as they are able to see many of these variations in the living subject. Davis found that in the right apical lobe the bronchus more commonly divided into two secondary bronchi and not three as usually described. Many variations were noted with regard to the size and length of the bronchus before division, also as to the angle at which branches were given off. The middle lobe bronchus presented variations which were still more marked. It appeared either as a lateral, a posterior or an anterior branch. In a number of instances, two separate branches supplied the lobe. In the right lower lobe bronchus, division into two or three branches occurred about equally. It was impossible to classify the divisions beyond this point because of the number of branches. The cardiac bronchus, which is usually given off between the office of the middle lobe bronchus and the division of the lower lobe bronchus, was the only bronchus found arising on the mesial side of the primary bronchus.

In the left apical lobe, the divisions were not unlike those on the right side. The size of the bronchi varied considerably, but the distance before branching was uniform. In the left lower lobe, the bronchus more often divided into three branches than into two.

FOREIGN BODIES IN THE AIR AND FOOD PASSAGES

In emphasizing that the function of the roentgenologist is chiefly diagnostic, Manges³⁷ observed that this involves not only the actual diagnosis of the presence or absence of a foreign body, but in the positive cases a description of the safety-pin, its size, the distribution of its parts, its physical characteristics and conditions, its effect on surrounding tissues, its variations or progress from day to day when not immediately removed and the anatomic characteristics of the patients. A roentgen diagnosis cannot be depended on unless the study includes the entire area of the alimentary and respiratory tracts, all clothing and other possible containers of foreign bodies having been removed.

Most types of foreign bodies have a tendency to lodge in some special part of the body, however, safety-pins may lodge in any portion of the alimentary or respiratory tracts. Above the level of the larynx the question of differential localization does not enter, below

³⁶ Davis, J. D. *Anatomic Variations of the Normal Tracheobronchial Tree*, Arch Otolaryng 9 404 (April) 1929.

³⁷ Manges, W. F. *Roentgen Observations on Safety-Pins as Foreign Bodies*, Arch Otolaryng 9 245 (March) 1929.

this however the foreign body must be specifically localized. A safety-pin in the larynx or trachea usually is found with its branches in the sagittal plane while in the esophagus the plane is coronal. To assist in localization the roentgenograms should be of such quality as to show the shadow of the larynx and trachea in sharp detail both antero-posteriorly and laterally. If the pin is at the level of the tracheal bifurcation it may be necessary to have the patient swallow a bismuth mixture to aid in establishing its true location. To demonstrate the actual size of the pin and the distribution of its parts, certain technicalities with regard to distance and to length of exposure are important. With perfect roentgenograms one can match pins with the shadows and often determine the exact type and size of the pin. Data regarding the thickness of the wire, the size of the wings of the keeper, the size of the spring coil and the presence or absence of a spring clamp should be secured.

Manges expressed his belief that the bronchoscopist should study the films with the roentgenologist to appreciate more fully these variations rather than depend on a mere description. In rendering fluoroscopic aid, the bronchoscopist must not expect undue help from the roentgenologist and should know whether tissue is included with the grasp of the pin. The roentgenologist should not be responsible for failures or accidents over which the bronchoscopist has control.

In addition to presenting a detailed report of 100 consecutive personal cases of foreign bodies in the air and food passages, Aucoin³⁸ gave the results of a statistical review of 1 000 successive foreign bodies removed at the Chevalier Jackson Bronchoscopic Clinic. These were distributed as follows: 99 in the pharynx, 440 in the esophagus, 11 in the larynx; 55 in the trachea, 377 in the bronchi and 18 in the stomach. Of the bronchial foreign bodies 65 per cent were in the right bronchus and 35 per cent in the left. Foreign bodies of vegetal origin constituted 23 per cent of the total number, coins 15 per cent and safety-pins 12.2 per cent, so that these three groups made up 49.2 per cent of the foreign bodies in a consecutive series of 1 000 cases.

Statistics further show that about 25 per cent of the foreign bodies occurred in adults and 75 per cent in children. Further analysis of the age ratio indicated that of the safety-pins and vegetal foreign bodies which constituted 38 per cent of the total number of cases and which are the most difficult type of foreign body to remove 69 per cent were encountered in children under 2 years of age. Of the author's 100 cases, 43 occurred in children less than 2 years of age.

³⁸ Aucoin, E. L. Peroral Endoscopy. Report of a Consecutive Series of One Hundred Foreign Bodies in the Air and Food Passages, *Arch. internat. de laryng.* 8: 513 (May) 1929, 640 (June) 1929.

These observations lead to the inevitable conclusion that the endoscopist must use small tubes and must be equipped with a complete instrumentarium adapted for use in small patients. With careful and systematized training in this work the results are uniformly excellent, in fact, the mortality rate in the group of 1,000 cases was less than 2 per cent, while in the group of 100 cases there was no fatality. The general principles underlying the diagnosis and treatment are emphasized.

Foreign Bodies in the Esophagus—In a review of cases of foreign body, Liu³⁹ found that esophageal foreign bodies are much more frequent among the Chinese than are foreign bodies in the air passages. The outstanding reason for this, he stated, is the fact that physicians, as well as the laity, understand the symptoms following esophageal obstruction by a foreign object. They do not, however, recognize the symptomatology of foreign bodies in the air passages, and it is a question whether they appreciate that foreign bodies can be inhaled. Among the esophageal foreign bodies, dentures and date stones are probably those most commonly observed. Economic conditions are largely responsible for neglect of dentures which are either ill fitting or broken. Date stones have sharp ends, which is probably the reason why they are found transfixed in the esophagus. Penetration of the esophageal mucosa and periesophageal abscess are not of uncommon occurrence. In five cases of esophageal obstruction by a date stone, two had extensive periesophageal infection with abscess formation.

After discussing certain features of the endoscopic work carried out during the past four years, Negus⁴⁰ agreed that for success in removal of foreign bodies from the bronchi, frequent practice in bronchoscopy is required and can be obtained only by the treatment of patients with lung suppuration, combined with practice on dissected lungs, rubber tubes and anesthetized animals.

A definite diagnosis of the presence or absence of a neoplasm of the lung can almost always be made by bronchoscopy. A simple new growth can be removed, even from a secondary bronchus. Abscesses of the lung, if in an early stage, can be cured by bronchoscopy. Bronchoscopic aspiration of pus-containing cavities in the lungs should be tried in all cases that do not respond to ordinary medical treatment, the use of drugs and postural drainage should always be combined. Bronchoscopy alone should not be continued if unsuccessful, the patient should be referred for thoracoplasty or other external operation.

39 Liu, J. H. Foreign Bodies in the Esophagus, China M. J. **43** 556 (June) 1929.

40 Negus, V. E. Peroral Endoscopy, Lancet **2** 60 (Jan. 12) 1929.

With regard to coins in the esophagus, Negus expressed the belief that an anesthetic causes a child a great deal more fear and discomfort than does the removal of the foreign body, which can be accomplished in a few seconds if the operator and his assistants are well practiced.

Foreign Bodies in the Air Passages—Cases of foreign bodies lodged in the larynx or upper trachea are often treated as cases of diphtheria. Isolation of these patients usually terminates the studies necessary in a case of foreign body, and too often this phase of the history is soon forgotten. Miller's⁴¹ case is typical. While eating meat from a bone, a girl who had developed an acute cold suddenly choked, screamed and then completely lost her voice. A diagnosis of laryngeal diphtheria was made, this was changed to laryngitis when the history of eating the meat was discussed. After a few days diphtheria antitoxin was given and the patient was sent to a hospital for contagious disease. After two weeks, the patient was discharged, however, the breathing was "bad," and she had a cough which was "due to bronchitis." This condition continued for a number of weeks, with an increase in the cough and difficulty in breathing. It was then diagnosed as spasmodic croup. Ultimately it was suggested that an endoscopic examination be made. By direct laryngoscopy a bone was found lying in the sagittal plane of the trachea, immediately below the level of the vocal cords. Following removal of the foreign body, the symptoms promptly cleared up.

Although in the following cases removal was not effected by endoscopic means, there were foreign bodies in the air passages, the unusual outcome of the cases was such that it was believed of interest to include them in this review.

Certain foreign bodies, notably grasses, such as timothy heads, frequently set up severe reactions in the pulmonary tissues, long-standing cases are commonly complicated by empyema. In the following case, reported by Larget and Lamare,⁴² a spike of oat grass was aspirated by a child, aged 2 years. There was a brief period of suffocation at the time of the accident. Following this bronchitis persisted, and an abscess of the lung developed. The process later involved the thoracic wall, and the foreign body was ultimately discharged.

Perforation of the pleura by a foreign body in the absence of manipulation is of rare occurrence. This is especially true if the foreign body is of vegetal origin. Graham's⁴³ case is remarkable in this respect. A child, aged 8 months, secured a branch of cedar and placed it in

41 Miller, J. A Tracheal Foreign Body Simulating Diphtheria, *Am J Dis Child* **38** 95 (July) 1929.

42 Larget, M., and Lamare, J. P. Migration of Spike of Oat Grass Through Respiratory Organs, *Bull et mém Soc nat de chir* **55** 26 (Jan 19) 1929.

43 Graham, H. B. Perforation of the Pleura by an Inspired Foreign Body. Report of Case, *California & West Med* **30** 120 (Feb) 1929.

her mouth. It was believed that the cedar was swallowed and not aspirated, as the child seemed normal. She continued so for two and a half days, when suddenly she developed shortness of breath and distress. A roentgenogram of the chest indicated a total collapse of the left lung. There was nothing to suggest a foreign body. A bronchoscopy performed on the fifth day after the accident was negative for a foreign body. The signs were typical of pneumothorax. Two days later, fluid was aspirated from the left side of the chest, and on the eighth day following the accident the child died. At autopsy, the left lung was found totally collapsed, fluid filled the left pleural cavity. There was a perforation of the visceral pleura over the left lower lobe, nearby was found a branch of green cedar. Perforation of the pleura evidently had occurred two and a half days after the accident.

Sudden death from asphyxia due to occlusion of the larynx by a previously aspirated foreign body occurs with sufficient frequency to warrant its consideration as a possibility in any case of tracheobronchial foreign body of considerable size. One would hardly consider intestinal parasites in the category of tracheobronchial foreign bodies. The case by Dixey⁴⁴ is of interest in this connection. A child, aged 8½ years, suddenly fell, gasping for breath, became unconscious and died within a few minutes. There was nothing to suggest the cause. At autopsy, when the larynx was removed, two large, round worms were found, on closer inspection, one was seen to be partially curled up in the larynx, and between the two of them the laryngeal lumen was completely occluded, preventing respiration. Death resulted from asphyxiation. Additional worms were found in the stomach and the small intestines.

44 Dixey, M. B. D. Sudden Death Due to Occlusion of Larynx by Two *Ascarides Lumbricoides*, Edinburgh M. J. **36** 111 (Feb.) 1929.

News and Comment

LARYNGOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE

Dr E Watson-Williams, Bristol, England, has been invited to collect cases of papillary granuloma of the larynx, with special reference to its occurrence after exposure to mustard or other irritating gases, for presentation at the June Session of the Laryngological Section of the Royal Society of Medicine

He would be grateful for any notes of cases of this rare condition, illustrations and microscopic slides especially, or any references to published cases or to occurrence apart from war service

Special points of note are (1) signs and symptoms, clinical appearances, (2) date of exposure to and nature of gas, (3) latent period, if any, (4) operative measures, exact site of granuloma and pathologic report, (5) examination of blood or sputum for syphilis and tuberculosis, (6) subsequent history

Communications should be addressed to Dr E Watson-Williams, Royal Infirmary, Bristol, England

COURSE IN OTOLARYNGOLOGY AT UNIVERSITY OF BORDEAUX, FRANCE

Prof Georges Portmann plans to give a special five weeks' course at the University of Bordeaux, France, for students in otolaryngology, beginning July 21, 1930. For further information apply to Dr Leon Felderman, Mitten Building, Philadelphia

Abstracts from Current Literature

Ear

PNEUMATIZATION OF MASTOID PROCESS AND MUCOSIS OTITIS II RICHTER,
Ztschr f Hals-, Nasen- u Ohrenh **25** 74 (Nov 14) 1929

Richter reports that in 208 of 225 patients in whom operation for mastoid infection or its complications had been made, bacteriologic and roentgen examinations had been effected. In 38.2 per cent *Streptococcus mucosus* was found. There was a preponderance of male patients. In thirty-seven subjects (40.7 per cent) an infection of the upper respiratory tract had preceded or was coincident with the condition. There were only four bilateral infections, forty-eight on the right and thirty-four on the left side. In forty-nine patients (57 per cent) complications were noted. Eight patients died, however, in two death was due to an intercurrent infection, the mortality was therefore 7 per cent. The condition of pneumatization of both mastoid processes was almost equal forty-two times (in 71.2 per cent) but appeared slightly inhibited in fifteen patients, in seventeen it was inhibited on one side only (28.8 per cent) in ten patients this was the afflicted side. On the basis of his experience Richter notes that *Streptococcus mucosus* was approximately equally prolific on the pneumatized and nonpneumatized mucous membrane.

NYSTAGMUS DUE TO VASOMOTOR DISORDERS O. MUCK, Ztschr f Hals-, Nasen- u Ohrenh **25** 88 (Nov 14) 1929

On the basis of an experimental study on forty normal subjects and on five deaf persons with deficient development of the ear labyrinth, Muck concludes that the rôle of vasomotor influence is considerable in development of diseases of the middle ear. Nystagmus coincident with a paling phenomenon may be observed after caloric irritation or by injection of epinephrine in normal subjects, this does not occur in those without a labyrinth. The head of the tested subjects was turned, this had given rise to transitory stretching of the vertebral artery which, according to Muck, is responsible for assisting in production of the syndrome.

FIBROMA OF COCHLEAR NERVE WITHOUT INJURY TO AUDITION E. SCHLITTLER,
Ztschr f Hals-, Nasen- u Ohrenh **25** 104 (Nov 14) 1929

Schlittler's patient aged 47, had been hospitalized for severe symptoms of purulent bronchitis and an aneurysm of the aorta. Examination of the ear had not disclosed any disorder, however, at necropsy, an extensive tumor with clearly defined limits was found in the right inner ear. Microscopic examination of the tumor showed that it belonged to the slowly growing type and had not caused destruction but had gradually displaced the cochlear nerve.

GRADENIGO'S SYNDROME ROENTGEN EXAMINATION OF ABSCESS IN MASTOID PROCESS M. BIGLER, Ztschr f Hals-, Nasen- u Ohrenh **25** 249 (Jan 25) 1930

Bigler points to the importance of combining clinical examination with roentgenography for early diagnosis. On the basis of the results reported in the literature and his personal experience in one case, he concludes that inflammation of the mastoid process is more frequent than has been noted heretofore. Neuralgia of the trigeminal nerve occurring after an otitis of several weeks' duration warrants thorough examination by roentgen rays, thus indication for operation may be disclosed at an early stage of the disease.

TRANSITORY HYPCUSIA AFTER CALORIC IRRITATION OF THE EAR LABYRINTH
O MUCK, Ztschr f Hals-, Nasen- u Ohrenh **25** 262 (Jan 25) 1930

On the basis of experiments on ten physicians and two other subjects with normal acuity, Muck states that after caloric irritation of the ear labyrinth a transitory hypacusia occurs which can be tested with the tuning fork C5. The hypacusia is on the same side if the ear has been rinsed with cold water, it is on the opposing side coincident with a vasomotor reflex action if hot water was used. It is possible that a cramp in a branch of the cochlear nerve is the cause of this reaction.

EFFECT OF TOBACCO AND TOBACCO SMOKE ON ACOUSTIC ORGAN AND VESTIBULE
OF THE EAR F LICKINT, Ztschr f Hals-, Nasen- u Ohrenh **25** 312
(Jan 25) 1930

After discussing the data obtained from the literature, Lickint comes to the following conclusions. Tobacco or tobacco smoke may give rise to an increased formation of cerumen in the external canal of the ear. Catarrhal infections originating in the nasopharynx often extend into the eustachian tube and from there penetrate into the tympanic cavity and involve the tympanic membrane. As a result, the tube may become blocked and through the constant chemical and mechanical irritation a chronic otitis media may develop. Secondary infections can occur by introduction of bacteria with tobacco particles and acute purulent otitis media can result. Toxic manifestations in the cochlear nerve are frequently noted and nervous disorders (otalgia) may be caused by nicotine. The membranous labyrinth may be injured by nicotine sclerosis of the blood vessels. Experimental proof of the extensive involvement caused by nicotine is in existence, and diseases such as Meniere's disease, vestibular nystagmus and labyrinth vertigo can result.

Pharynx

ETIOLOGY OF ADENOIDS. STATISTICAL INVESTIGATION E SAARESTE, Monatschr f Ohrenh **63** 824 (Aug-Sept) 1929

In 1,366 school children from Tartu (Dorpat), Esthland, Saareste examined the relative extent of the tonsils by means of pharyngoscopic and post-rhinoscopic methods. Adenoids were evident in 659 children (48.2 per cent), 459 had minor growths (33.6 per cent), in 148 children (10.8 per cent) the vegetations were of medium size, in 52 (3.8 per cent), large adenoids were seen. Hypertrophic tonsils were seen in 430 children (31.5 per cent). Three hundred and twelve children (22.8 per cent) had adenoids and hypertrophic tonsils. Spontaneous involution of the adenoids occurred in general at the beginning of puberty (about 13 years of age) but was observed to a slight degree at 10 years. Children from poorer classes had larger adenoids than those in higher schools. Fifty-two and three-tenths per cent, or 429 children having adenoids lived in the city, whereas 42 per cent, or 230, were country bred. Of especial interest was the fact that large adenoids were found in 5.4 per cent of the city children, but in only 1.6 per cent of the country children. There was no evidence that scarlet fever or measles had had any influence.

Larynx

SENSORY INNERVATION OF THE LARYNX G HOFER, Monatschr f Ohrenh **63** 1277 (Dec) 1929

Hofer discusses this problem on the basis of experimental exclusion of the laryngeal nerve in eight patients and a review of the literature. His pictures illustrating the anatomic structure are clear, and an abstract without them therefore loses in value. As a result of his study, Hofer states that the superior laryngeal nerve is sensory from the entrance of the pharynx to the lower portion of the vocal cords. Its branches, however, are chiasmic and reach into the hypoglottis.

where they constitute a bilateral innervation. The lower laryngeal nerve is not only a motor nerve but a mixed nerve. It gives off its sensory innervation to the lower (hypoglottis) part of the larynx as far as the third or fourth segment of the trachea reaching up toward the vocal cords. Also here the fibers are chiasmic and carry out the function of bilateral innervation. Beyond this point the inferior laryngeal (recurrent) nerve reaches up above and beyond the vocal cords, although not so abundantly as the superior laryngeal nerve branches out from above. The larynx is thus enclosed by all four branches of the vagus nerve in a sensory network. The fibers of both sides as well as those from the upper and lower nerves are partially interlaced. Individual variations are noted in the form of unequal distribution of areas of anesthesia or restoration of sensibility after unilateral exclusion of a nerve, however, according to the author this gives additional proof for the extent of the vicarious innervation of the sensory laryngeal nerves in man.

ACUTE INFLAMMATORY EDEMA OF LARYNX WITH DIPHTHERIA BACILLI HUBNER,
Ztschr f Hals-, Nasen- u Ohrenh **25** 107 (Nov 14) 1929

On the basis of his personal experience in five patients with a positive culture and three with edema and sore throat but in whom no diphtheric bacilli were found, Hubner concludes that for development of true diphtheria several interacting factors are essential. In four other patients no cultures had been made, but identical symptoms were noted. The virulence of the bacilli is of equal importance as the appropriate environmental conditions. Failure of the organism to produce antibodies likewise favors the development of the disease. Hubner points to the resemblance of the symptoms in his twelve patients to erysipelas of the larynx. The characteristic temperature curve was not evident, however, and likewise the tendency of involvement of the trachea, pharynx or face was lacking. From a discussion of his observations the author concludes that the mucous membrane of the larynx can harbor diphtheria bacilli the toxin of which gives rise to edema without the formation of a pseudomembrane.

Nose

REGENERATION OF THE MUCOUS MEMBRANE OF THE NOSE AFTER SURGICAL INTERVENTION D. N. MATWEJEW, Monatschr f Ohrendh **63** 1293 (Dec) 1929

On the basis of his personal experience in twenty-five patients and a review of the literature, Matwejew stresses the importance of preserving intact, as far as possible, the physiologic functioning of the mucous membrane of the nose. In eight patients in whom thermocautery was done and in six others who had been treated with caustics, regeneration of the mucous membrane did not occur. On the contrary, its functional activity was inhibited, and a chronic catarrh resulted. Such radical treatment should therefore be made only when the glands and erectile tissue have already been destroyed by pathologic processes. After turbinectomy, which was done in six patients, healing occurred with the formation of a narrow scar as a result of fusion of the margins of the wound by connective tissue. The mucous membrane containing the glands and the erectile tissue had been kept intact. The author advises performing turbinectomy rather than cauterization in all cases in which complete degeneration of the mucous membrane has not yet occurred.

TREATMENT OF CHRONIC CATARRHAL RHINITIS AND HAY-FEVER WITH EPHEDRALIN-MERCK (AN EPHEDRINE COMPOUND) E. FISCH, Monatschr f Ohrenh **63** 1313 (Dec) 1929

Fisch reports that in nineteen of twenty patients (the clinical histories of three typical cases are described) treatment by injection of preparations of synthetic ephedrine and epinephrine was successful. There were fourteen patients suffering

from chronic catarrhal rhinitis, five had hay-fever and one a condition of epiphora. That the injection is given only subcutaneously and that the surface of its distribution is as large as possible should be noted. Transitory symptoms of perspiration, feeling of cold, tremor and paresthesia are sometimes noted at the site of injection and can be controlled by advising the patient to rest for several minutes after the injection. Fisch stresses the fact that hypertonia or a leaning toward hypertension is contraindicated to this treatment and he points to the importance of recognition of pathologico-anatomic conditions demanding operative intervention before medication.

MOID FUNGUS DISEASE OF MAXILLARY SINUS. M. MOLLARI. Ztschr. f. Hals-, Nasen- u. Ohrenh. **25** 65 (Nov. 14) 1929.

Mollari reports the rare incidence of a mycosis in the maxillary sinus of a woman, aged 74, in whom a tentative diagnosis of a malignant tumor had been made. On microscopic examination the presence of an almost pure culture of fungi resembling *Aspergillus niger* was noted. The author believes a genus of ascomycetous fungi to have caused the disease and points to the importance of considering the possibility of fungal infection and of making cultures accordingly before fixation of tissue removed for examination.

TRANSITORY AMAUROSIS IN LOCAL ANESTHESIA OF SEPTUM. E. LEVY, Ztschr. f. Hals-, Nasen- u. Ohrenh. **25** 245 (Jan. 25) 1930.

In Levy's patient, aged 16, injection of a solution of cocaine and epinephrine in preparation for operation of a deviated septum had caused this accident. The patient complained of severe pain in the left eye shortly after the injection coincident with complete blindness, and the operation had to be postponed. Levy reviews the literature and concludes that amaurosis can occur if the pressure of the injected fluid is too great coincident with anomalies in development of the arteries. If the injected substance is easily absorbable, the amaurosis is transitory as it was in his patient; however, if a substance such as paraffin is injected, a permanent injury to the eye can ensue.

Society Transactions

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOTOLOGY AND LARYNGOLOGY

Oct 18, 1929

GEORGE M. COATES, M.D., *Chairman*

SOME PROBLEMS IN OTORHINO-LARYNGOLOGY HERBERT THILLY, B.S.,
London

It would be difficult for me to express how keenly I appreciate the honor of being the guest of this section this evening and of having been invited to address an audience composed of so many distinguished physicians in our particular branch of medicine. The task of preparation has been difficult and would have been still more so had you not given me permission to ramble where fancy might lead me, even if this should involve some retrospects of a pilgrimage of nearly thirty-five years.

In the early days of that period I saw and, I hope, shared in the successful struggle for the recognition of diseases of the ear, nose and throat as a special department of medicine, and for its being placed on an equal footing with obstetrics, psychiatry and those other branches of our art and craft which require special and prolonged training. Today practically every large hospital in Great Britain has its ear and throat department, and many of the smaller hospitals in country towns and districts have arrangements whereby they can obtain the services of an expert whenever necessary. Furthermore, a Bachelor of Surgery of the London University can take the degree of Master of Surgery in otorhinolaryngology, and a special diploma in these subjects may be obtained, under certain conditions, by a member of the Royal College of Physicians and Surgeons.

In other universities, i. e., Edinburgh, similar facilities are offered to graduates who have taken up the study of particular subjects.

If time permitted, I could tell you who live in this comparatively young and enlightened country some astounding stories of the difficulties we encountered in gradually overcoming the conservatism, the vested interests and often the jealousies of those to whom tradition and precedence were as the breath of life.

Otology—As otology is the senior member of our trilogy, I shall consider one or two of its problems that often confront us in our daily work. Before doing so, however, I should like to interject one or more retrospects. When I graduated in 1890, my teachers occasionally performed a cortical mastoid operation and left the postaural wound widely open. This was packed daily for from six weeks to two months until the wound had healed. I remember one patient who was allotted to me when I was "dressing" for my chief, and that patient is now Surgeon-Admiral of the British Fleet. If the complete tympano-antral operation was performed, no meatal flap was cut and the postaural wound was dressed in the way I have already stated. You will realize the tedium such after-treatment inflicted on both the patient and the surgeon.

In 1886, the first successful operation on an otogenic abscess of the brain was performed in University College Hospital by the late Arthur E. Barker, who was then one of the assistant surgeons of that institution.

Practically nothing was known in those days with regard to labyrinthine tests in health and in disease, and consequently the medical or surgical treatment for inflammatory lesions of the internal structures of the ear scarcely existed.

The symptom-complex which is spoken of as Menière's disease was, of course, well known to physicians, and one of my teachers, Sir William Gowers, maintained that vertigo was of aural origin in 90 per cent of cases

The late Mr Mark Hovell, aural surgeon to the London Hospital, was more explicit as to the nature of the ear lesion and recorded that most of his patients who consulted him for vertigo suffered from postnasal catarrh, and as this could be relieved or cured, the attacks of giddiness would be minimized in their frequency and severity. Many of us who were his juniors have since then amply proved the correctness of his observation

In the early part of this year, Mr Sidney Scott (*Proc Roy Soc Med*, 1929) again upheld the same view, and said that the largest class of recurrent vertigo is "associated with inefficiency of the eustachian tube mechanism"

Let me give you two illustrative examples, both of the patients are medical friends of mine, and this is what they have written to me

"Dr M T was seen by me in August, 1925, for attacks of vertigo similar to those which he had had for thirty years previously and about the time of puberty. Since then the attacks were more frequent in the summer, but for the last two years there had been no seasonal incidence. The general health was good and he was never 'off work'. He says, and this is significant 'I am usually able to avert a bad attack by a gentle valsavian insufflation'."

My second friend sent me the following more detailed account of his attacks

"In June, 1928, I had an attack of giddiness, during the first day of which I vomited several times. Dr James Collier kindly visited me twice when I was at my worst, but he found, I believe, no objective phenomena. I was not confined to bed although I was on a couch most of the day. I was considerably troubled by loss of co-ordination in my legs, I dreaded passing the stairs to my basement, and was troubled in crossing the pavement between my car and the house I was visiting

"The attack ended in a dramatic manner after I had been ill for about a month. One afternoon I reached home about 5 o'clock, sat down in an armchair with a daily paper and fell asleep. The extension telephone in my bedroom rang, and I jumped up and went to it. As I passed a looking-glass, I noticed that my face was very pale. After answering the phone I fell upon the bed, and laid there for a few minutes. When I got up my giddiness and loss of co-ordination had completely disappeared

"From then until Feb 1, 1929, I was well. On February 1, I had a busy day and got home for an appointment at 5 15 p.m. I saw my patient out at 6 o'clock and immediately became giddy and vomited. I went to bed feeling very ill, I was giddy and vomited frequently. I had intense photophobia, the slightest ray of light made me vomit. I could not bear the light from the gas fire and a screen was placed round my bed to keep out the light from the street lamps, etc, although the windows have venetian blinds and curtains

"On the following day (Saturday), Dr Gordon Holmes visited me twice. I was vomiting when he arrived at 9 a.m. He gave me a mixture of sodium bromide, chloral and prussic acid, and the vomiting ceased. He told me that I had well marked nystagmus. I remember nothing more about that day except that I lay with my head under the bed clothes because of the light, and I had complete anorexia

"The whole attack passed off in a few days after which a friend kindly put her car and chauffeur at my disposal. I used it for about a month and then took out my own car

"Only once since have I had any sign of the sickness and it only lasted half a day

"My vertigo was, with the exception of the February attack, only slight, everything was on the move

"My wife and daughter told me that they knew when I was unusually ill, by my pallor

"I am not a bilious subject, am never troubled by constipation and I never vomit. I have never suffered from any ear trouble. I had no pain."

Aug 29, 1929

G W I"

In this interesting clinical account of my friend, one notes the recurrence of visual and gastric disturbances and the cardiovascular symptoms of pallor and collapse. These were not the causes of the vertigo but, as Sidney Scott said, they must be regarded as "secondary reflex results of the excessive stimulation of the vestibular centers in the medulla."

On my return from vacation, the second patient came to me, still feeling rather unsteady, but with deafness in the right ear as his chief complaint. The ordinary tests showed the condition to be of middle ear origin. I inflated his tubes and the effect was dramatic, for the hearing immediately returned, the dizzy feeling disappeared and he walked out of the room in high spirits and with the greatest assurance. There has been no recurrence of the vertigo.

In both patients it is clear that this symptom was caused by occlusion of one of the eustachian tubes. And how serious it may be in air pilots and in the personnel of submarines. I have often wondered whether vertigo may not account for some of the deaths from drowning during the holiday seasons, i. e., a sudden attack of giddiness with possibly a cardiovascular disturbance due to water entering one eustachian tube, rather than to the so-called "muscular cramp."

Before leaving the subject of vertigo, I should like to mention those cases in which Meniere's syndrome is caused by an abnormally low blood pressure, rather than by a high arterial tension with which all are familiar. My colleague in the Royal Ear Hospital, Mr. Richard Lake, was, I believe, the first to draw attention to this factor. One of my patients was an elderly woman who for months was almost bedridden by frequent and severe attacks of vertigo. Bromides and the other usual remedies failed to give relief but an ergotine preparation would almost immediately cure an attack, and when this treatment was followed by cardiac tonics the patient resumed the ordinary quiet routine of her daily life. But she always kept this preparation at hand.

Coming to chronic suppurative lesions in the cleft of the middle ear, I should be glad to know your experiences in the surgical treatment for attic suppuration, i. e., are you in favor of ossiculectomy or do you find that a conservative operation on the mastoid is the better procedure? My experience would seem to show that the main cause of chronicity lies in the infected antrum or in its adjacent mastoid cells and that a postaural operation is more likely to cure the discharge from the attic and to conserve whatever hearing there may be in the affected ear.

Again, what has been the experience of those of you who have tried immediate closure of the wound after a simple, or Schwartz's, operation on the mastoid, whether for acute, subacute or possibly chronic suppuration?

About twelve or thirteen years ago I showed before our Section of Otology of the Royal Society of Medicine, five consecutive cases in patients in whom the method had been adopted with success. In one of them a perisinus abscess had been present. The technic included the removal of every visible focus of infection, the application to the bone wound of hydrogen dioxide solution, then of methylated spirits and finally a free application of bismuth and iodoform suspended in liquid paraffin. After insertion of the skin wound sutures, pressure is applied to the wound in order to squeeze out as much of the bismuth and iodoform paraffin mixture as possible.

The longest time any of these patients was in the hospital was sixteen days, an enormous saving of time compared with the usual requirement. I have had no fatal result or any complication more serious than the recurrence of discharge in a few patients which necessitated the opening of the lower part of the wound to provide for drainage until the usual obliteration of the wound by granulation tissue took place.

The patients who do best are those in whom the suppuration has been present for from five to six weeks and therefore I presume that some protective immunization has been secured. In two acute cases the edema over the mastoid process was

one-half inch (1.27 cm) thick, and yet the patients did well and the wound healed by immediate union. The method has been successfully adopted by Guthrie of Edinburgh, by McNab of Johannesburg and by others, but it was not so generally adopted as one might have expected by those whose asepsis and surgical technique are of the highest order. One is quite aware of all the theoretical objections against immediate suture, but by practical experience they appear to be possibilities rather than probabilities. I was encouraged to adopt the method because of the successful result that followed the bismuth, iodoform paraffin paste in the treatment for wounds during the World War.

I should now like to record a case which is unique in my experience, one of pyemia of aural origin without sinus thrombosis. Korner of Frankfort-am-Main was the first to describe such instances and the late Henri Luc (Paris) published reports of two cases from his own practice, you will find them in his "Lectures on the Suppurations of the Middle Ear."

My patient was a finely built boy in one of our public schools. He had had an acute otitis of the left ear quickly followed by discharge. This ceased in a few days, but the temperature, instead of falling, increased in its daily excursions until, when I saw him some three weeks later in consultation with his medical attendants, the following conditions prevailed:

The tympanic membrane was normal, and the hearing was little inferior to that of the sound side. The soft tissues over the mastoid showed no sign of present or past inflammation, and deep pressure on that process elicited no discomfort, nor was there any tenderness or swelling over the course of the jugular vein. The patient felt well except when the evening temperature rose to from 102 to 104 F. He was cheerful to the extent of facetiousness, and said he was looking forward to a good dinner. The temperature chart was of the swinging type, such as one would expect in a patient with septic thrombosis of the lateral sinus. The urine was normal. No blood examination was made. On further general examination, I found a tender area over the symphysis pubis, another behind the left trochanter and another in the left gastrocnemius muscle.

It seemed, therefore, that my associates and I had to deal with a case of pyemia with distal foci of aural origin typical of those described by Korner and Luc.

A few days later, right pneumonic symptoms with pleurisy developed, and the boy died. To add to the tragedy, I may mention that he was an only son and captain elect of his school.

The pathologic process in such conditions is not clear, but the theory most in favor is that the pyemia results from minute septic thrombi in small veins of the mastoid process which pass through the pulmonary capillaries and find lodgment in distant regions. In lateral sinus thrombosis, the larger thrombi become lodged in the pulmonary vessels.

What should have been our treatment? I advised against exploration of the mastoid and lateral sinus because I knew that this had been done in other cases without finding any focus of infection, and that in two fatal cases, the pathologists found no evidence of mastoid infection or of sinus thrombosis. Furthermore, the literature on the subject clearly showed that if during the remissions of temperature, the general condition of the patient was good, recovery usually took place. And as I have said, there was no sign or suggestion of any mastoid or sinus complication.

I still think that I was right in not operating, but shall esteem any favorable or adverse criticism which you may care to offer, especially if such is the result of practical experience.

At the present time, I have a little boy under my care who has recovered from bilateral acute suppurative otitis media. The left mastoid was opened and found to be infiltrated with pus. His temperature still continued to rise every evening to from 102 to 103 F for three weeks, at which time the left external rectus became paralyzed and the temperature rose to 104.8 F and was accompanied by temporal headache. In the meantime, the discharge from the right ear had

ceased. The wound was explored and the apex of the petrous pyramid was searched for a possible cause of these symptoms, but without result except for the escape of a considerable quantity of serous fluid. Still the swinging temperature was maintained, but all the time since the commencement of his illness, during the remissions of temperature, the patient read story books, was interested in all that went on around him and was always ready for his food. The sixth nerve paresis is now quickly subsiding, his temperature has been practically normal for the last week and he is running about the ward. Was this a case of aural bacteremia as first described by Gruening of New York, which has been slowly overcome by natural processes? In view of the persistent septic type of temperature, the supervention of Gradenigo's symptom, and the temporal headache, was I right in making the second exploration? It was so difficult to stand by and do nothing in face of so many grave possibilities. Here again I invite any criticism born of your experiences, and ask whether you have found autogenous vaccines from blood cultures, subcutaneous injection of physiologic solution of sodium chloride or the internal administration of methenamine of any value. Blood cultures failed to show any organisms.

I wish to mention another small point of practical interest before leaving the subject of otology. Many years ago I had under my care, at surprisingly brief intervals, three patients with sarcoma (or endothelioma) of the nasopharynx, and in each patient an early symptom was deafness due to the accumulation of a viscid mucoid secretion in the tympanum, on the side corresponding to the primary nasopharyngeal lesion. Paracentesis, in such cases, naturally failed to give more than temporary benefit.

Further experience has led me to believe that this symptom is common and that its significance may easily be overlooked if one fails to examine the posterior nasal regions. Sir William Milligan has emphasized the same points.

Rhinology—Chronic nasal catarrh is probably the commonest symptom for which patients consult the specialist. Its causes are to be found in the standard textbooks, but I should like to emphasize a few factors on which, I think, the authors do not seem to lay sufficient stress.

We all know that adenoids or adenoids and tonsils are the most frequent cause of chronic nasal catarrh in children, while a relatively small number may be due to an added sinus infection. The treatment for such conditions is obvious. But there is often more difficulty in curing the trouble in adult people, in whom such definite conditions do not exist. I would humbly suggest that one reason for our failure is that the posterior rhinoscopic mirror frequently does not reveal the fibrous and septic remains of old adenoids which digital examination or endorhinascopy would detect.

Secondly, many intractable catarrhs are caused by secretions from polypoid degeneration of the antral mucous membrane. Hence my practice that if no obvious lesion be visible or palpable in the nasal passages, I puncture and irrigate the antrum, and as often as not the lotion brings away a large nummulation of mucus or mucopus. In mild cases a few irrigations followed by injections of 15 per cent mild silver protein will bring about a cure. If such fails to do so an operation to provide for free naso-antral drainage will often secure the desired result. It is surprising how often the antral mucous membrane undergoes polypoid degeneration without any sign beyond a chronic nasal catarrh.

I scarcely need dwell on the diagnostic value of injections of iodized oil into the antrum followed by roentgenography, especially when one antrum is affected by polypoid degeneration of its mucous membrane or when its lumen is invaded by a new growth.

Having spoken of a common nasal condition, may I give a brief account of a rarer condition, namely, aspergillosis of the maxillary antrum. One may find an account of it in the *Proceedings of the Royal Society of Medicine* (1914-1915, vol. 8, part 2), and I think it was the first record of the condition as observed in five patients.

The symptoms were violent sneezing, expulsion of grayish-white, semitranslucent, viscid lumps of mucus, headache and neuralgia around the cheek and eye, which in one patient was so severe as to prevent sleep. The nasal mucosa was pale and edematous, and the swelling was not reduced by the administration 20 per cent cocaine.

In two patients, the inner nasal wall bulged into the nasal cavity. No fluid returned on attempted irrigation. In one case, the ethmoidal cells were involved.

On opening the antrum through the canine fossa, a bluish-gray mass presented itself, and on removal it proved to be a sticky mass resembling the contents of a muscatel raisin. The Caldwell-Luc operation was performed in each instance, and the trouble quickly disappeared after irrigation with warm physiologic solution of sodium chloride for about ten days.

The pathologic process underlying the condition was established by the late Prof. S. G. Shattock, who stated that the material consisted of a homogeneous matrix containing scattered spheroidal cells which in some regions were grouped into narrow lines and consisted of polymorphonuclear cells. A microscopic section resembled an endotheliomatous tumor of the salivary gland. In certain cases the viscid mass was permeated by a well developed mycelium which differed from that of thrush (*Blastomyces albicans*) in that its extension did not take place by constricted budding but by simple lateral extension of short processes of uniform diameter.

I should like to show you this unique specimen of osteomyelitis of the calvarium and also some slides sent to me by my friend, Logan Turner of Edinburgh, which show possible tracks of septic infection of the meninges which may follow operation on the ethmoid labyrinth.

It is historical in the sense that it was the first recorded case of its kind and followed an operation for bilateral suppuration of the frontal sinuses performed by me in 1899 (*Brit M J*, 1899). Many extensive but superficial operations were performed in the hope of checking the spreading inflammation, but after nine months of suffering the patient died and the autopsy revealed foci of suppuration in many of the internal organs.

If one had the misfortune to meet with such a complication today, there would be no hesitation in exposing the whole frontal bone, and commencing on a healthy area well beyond that infected, the whole thickness of the bone would be removed, including the inflamed regions.

I know of only two precautions which may prevent or minimize the chances of such a complication, viz., to provide for free drainage from the operated sinus and in no circumstances to employ a curet for the removal of diseased mucous membrane, which can easily be done with blunt forceps or with wool firmly twisted on a probe.

Throat—The mere mention of the region of the throat suggests that thread-bare subject the tonsils. I can imagine you, Mr. President, rising in authority from your chair and saying, "I forbid." If you do so, no one will be more grateful than I, because only a few hours ago I raised some issues on the subject in Chicago, and, wondering how many enemies I might have made, I took the train the next morning, in my haste to reach Philadelphia, which from its name and all I have heard of it, deserves the distinction of the "City of Brotherly Love." One problem I did not mention in Chicago may perhaps be mentioned here. On the assumption that no tonsil can at any time be entirely free from pyogenic and possibly pathogenic organisms, what macroscopic and early clinical signs have we that it has reached a stage which renders it a possible focus of local or systemic infection?

Your colleague, Dr. G. B. Wood, has emphasized the pathologic significance of excess of polymorphonuclear cells in the crypts or making their way thereto through the epithelial cells that line those recesses. But the surgeon needs to find some early evidence of disease with the naked eye if he is to make a proper selection of patients for surgical treatment.

A slight enlargement of the tonsils is not necessarily a call for enucleation because it will frequently subside by the establishment of normal nasal respiration, e g, marked septal deflection or moriform hypertrophies of the posterior ends of the inferior turbinates. Nor is the presence of physiologic debris in the tonsillar fossa necessarily a condition requiring surgical treatment. If it were so, "Who amongst us shall escape whipping?"

In this matter I would ask, how far has Dr French's tonsilloscopy helped you?

Another point I would like to mention deals with the question of checking hemorrhage during and after tonsil operations. There are many well known operators in all countries who advocate stopping the bleeding by pressure of gauze swabs or sponges. I ask them or any surgical confrere, Why adopt a measure for arterial bleeding in a tonsil recess which would not be employed in any other accessible region of the body?

With a little practice one can find and ligature the chief vessels in a few seconds and leave the home or hospital with an easy mind. How can one do so when one knows that the strain of vomiting, or restlessness, may burst open an unsecured vessel? Let us think for a moment of the resulting anxiety for relatives, to say nothing of the additional suffering of the patient, and, maybe, the safety of his or her life, for which one has made oneself responsible.

That such is a common complication is proved by the flow of literature on the subject and the frequency with which instruments are being devised to avoid it. Of its possible seriousness, we, no less than the public, are aware. Let me read you what the experienced and shrewd observer, the late Mark Howell, said on the subject eight years ago, on the occasion of the Summer Meeting of the Section of Laryngology, of the Royal Society of Medicine, London.

"It has often been stated that the hemorrhage which follows tonsillectomy is of but little consequence, but possibly opinions differ as to what is considered a serious extent. Rather more than a year ago I heard from a creditable source that a throat specialist had then had four deaths from hemorrhage following the enucleation of tonsils but since then I have not been in a position to hear of his more recent contributions to the cemetery. As regards the members of this Section, I will not refer to deaths but will merely mention that to my knowledge there is more than one of them who, following enucleation of the tonsils, has been confronted with hemorrhage to a degree which caused him grave anxiety."

In my own practice, by ligaturing the descending branch of the posterior palatine above, and often the tonsillar branch of the facial below, I have, in 1,000 carefully recorded cases, reduced my average of postoperative hemorrhage from 5 per cent to less than 1 per cent. One of my students has written that I am in the habit of saying, "You should ligature the vessels in every case whether it be in a man, woman, child or curate."

If I am too dogmatic on this point, it is because, as I have already said, we cannot have too great a regard for the safety and sanctity of lives entrusted to our care.

Laryngology—As my friend, Sir St Clair Thomson, has been blazing laryngologic trails through the United States, it is obvious that I need say nothing concerning malignant and tuberculous diseases of the larynx. However, I should like to show you two slides. The first is that of a larynx from which an epithelioma of the right vocal cord was removed, and you will note its healthy cicatrix. Thirteen years later I was called to see the patient because he was having great difficulty in breathing. He was practically moribund when I arrived, and died a few hours later. The larynx was removed, and you will see a growth on the left vocal cord from which a section was made. Another patient of mine, from whom I removed a primary epithelioma of the vocal cord, died fourteen years afterward from recurrence of disease, not in the larynx but in the scar of the skin incision, and infiltration of the adjacent regions quickly followed. A third patient died of cancer of the prostate seventeen years after the removal of a primary epithelioma of the vocal cord.

What do such recurrences imply? The late Professor Shattock once told me that he was of the opinion that during its growth, a cancer produced a certain degree of immunity, and after operation the patient would live (qua cancer) until such protection was exhausted. Then any cancer cells which had lain latent might become active again, either locally or in some more distant area. Had cancer cells lain dormant within the scar of my patient for fourteen years, until a lost immunity enabled them to become active again?

My second slide shows the transverse section of a normal vocal cord stained by Unna's acid orcein which shows the distribution of elastic tissue. It also enables one to define the true vocal cord as that portion which is covered by squamous epithelium. You will notice where this passes into the ciliated epithelium leading toward the floor of the ventricle on the upper surface of the cord, and to that of the subglottic region below.

A squamous epithelioma may develop only within the limits of the squamous epithelium. In the elastic region there are few mucous glands, and hence an adenoma of the true vocal cord is of rare occurrence.

Finally, a rare specimen of intratracheal, or to be more exact, tracheobronchial papillary granuloma may be of interest. I removed it from a healthy young man who had been gassed in the World War. From within a few hours of inhaling the mustard gas, he suffered from paroxysms of cough. In the course of a few weeks he complained of difficulty in breathing, and when he visited me the distress was painfully obvious. Laryngoscopic examination revealed a tumor in the lower end of the trachea which moved upward on expiration and downward on inspiration, a ball-valve type of obstruction and therefore suggesting a pedunculated and probably benign formation. I removed it by peroral tracheobronchoscopy the next day. It was attached to the left main bronchus just beyond the carina. In spite of a free application of cocaine and epinephrine solutions, the bleeding was free, but the patient made a quick and uninterrupted recovery. Probably the mustard gas caused an ulcer and its granulations gradually hypertrophied until the inspiratory and expiratory current of air-couples with the violent coughing spasms brought about the formation of a pedunculated, vascular granulomatous tumor.

And now, Mr. President and gentlemen, I have only to thank you for your kindly forbearance in listening for so long to some of the incidents and impressions gathered on my pilgrimage to the terrace from which I have looked backward.

Of all the factors that have relieved the strife, disillusion and failures on the journey, the two greatest have been, (1) the joys of friendship and encouragement given to me by my fellow travelers, as you have done this evening, and (2) the steady realization that year by year otology, rhinology and laryngology were establishing their fair names in the science and art of medicine. Perhaps such sentiments would be more gracefully rendered by the well known lines

"Contend my soul, for moments and hours,
Each is with service pregnant, each reclaimed
Is like a kingdom conquered, where to reign"

DISCUSSION

DR. ALEXANDER RANDALL. All cases of chronic suppuration are due to cholesteatoma. If we have a matrix of cholesteatoma we are bound to have an overgrowth of endothelium. Pearl-like masses form and may be compared to those in epitheliomas. They represent a new growth. It is necessary to remove not only the dead bone but also the matrix from which new epithelial masses form. This should be strongly emphasized.

DR. JAMES A. BABBITT. I should like to know the essayist's opinion of the partial procedures recently advocated, such as the removal of the external wall of the attic alone.

DR. MATTHEW ERSNER. Dr. Coates has been an advocate of the blood clot method of closing mastoid wounds. Sometimes a small drain is placed in the

antrum The pathologic process is checked with the cytology If the polymorphonuclear count is rising and the total count is falling, either complete closure or the blood clot method is used One may even close the mastoid wound with a perisinus abscess present, should the polymorphonuclears rise and the total count drop The osteogenic substances present eventually help in judging the best method of closure In suppurative otitis media one must politzerize and massage as soon as possible to prevent adhesions

Hypertrophic tissues may be present in the antrum without suppuration or nasal symptoms Here iodized oil is a great aid in diagnosis I am wondering whether salicylic acid in alcohol would be of value in mycelial infections of the antrum

Why is not osteomyelitis observed more often in surgical procedures on the mastoid, one cures there?

DR GEORGE M COATES We cannot say definitely that ossiculectomy or the various types of mastoid operation are the proper form of treatment until the specific case is analyzed Suppuration may be maintained by the necrosis of ossicles or by adhesions forming pus pockets In such instances ossiculectomy is of value but the patients must be carefully selected When the suppuration is not too deep-seated, drainage may be obtained by taking away the external wall of the attic or the aditus as well A more radical operation may be done later if these measures fail

Whether a blood clot dressing or a modified blood clot dressing is used is a matter of diagnosis If the condition in the middle ear has cleared up before operation, a deep closure will give a healed wound in the shortest possible time without danger to the patient If trouble arises, the wound may be reopened

In hyperplastic maxillary sinusitis with indefinite symptoms, iodized oil gives a fine outline and differentiates dentigerous cysts from hyperplastic mucous membrane

DR FIELDING O LEWIS Douglas Harmer has treated patients with cases of carcinoma of the larynx by radium alone It has been a failure in this country Some success has been attained in extrinsic cancer by the combined treatment

DR SAMUEL SKILLERN If the negative washings from a hyperplastic maxillary sinus are poured into a tumbler, especially in a cold temperature, an albuminous, reddish material settles out on the bottom The hyperplastic antrum gives a different feel to the puncturing needle There is also a "hang" to the needle if one moves it around inside the antrum

DR GEORGE MARSHALL Politzer controlled the hemorrhage of aural polyps by snaring and applying ferric chloride, U S P This absorbs atmospheric moisture rapidly and acts as a superficial cautery In the case of the septic tonsil, if one goes into deeper tissue and ligates, there is a possibility of further infection

MR HERBERT TILLEY I am undecided about the different methods Ossiculectomy is often followed by drying up of secretions, but one must consider hearing The patient should be informed of the future The treatment should depend on the condition of the other ear, and each case must be considered on its merits In the majority of cases, I would do a postaural operation

When iodized oil shows hyperplastic changes, I treat the simpler cases by injecting mild silver protein

Osteomyelitis does occur in the temporal bone, and I had to turn a flap downward on several occasions It is, of course, rare The variation in the blood supply is the main reason for the rarity of temporal osteomyelitis

I have seen some of Harmer's patients, and the larynx in each one appeared quite normal after treatment I think this method will revolutionize laryngeal surgery when the cases are seen early In three or four months it is necessary to look at a diagram to tell where the lesion was

Dr Marshall mentioned ferric chloride, U S P I will try it in tonsillar hemorrhage, but I always feel safer when I ligate

Nov 20, 1929

H P SCHENCK, M D, *Reporter*

GEORGE M COATES, M D, *Chairman*

TIC DOULOUREUX, NASAL IN ORIGIN DR GEORGE MORLEY MARSHALL

Dr Marshall reported the case of a woman, aged 62, giving the history of intermittent pain, starting in the upper lip, near the left naris, going across the left side of the face to the temple, thence to the forehead and back of the eye. Occasionally, the greatest pain was near the lip and nose. The attacks had occurred for four years. Pain would continue for about three minutes and then disappear for from fifteen minutes to an hour or more. This condition would last for weeks at a time. The pain could be started by placing the finger on the lip at the left naris or could be stopped, temporarily, by pressure on the side of the nose at the point where the left nasal bone and the left nasal process of the superior maxilla join. The former probably increased turgidity and pressure, while the latter cut off the arterial blood, reducing turgidity and pressure.

The left turbinates were found to be crowded, the lower being large and hard and impinging on the floor, even when retracted by cocaine and epinephrine, so that a fine Harrison-Allen applicator could not pass beneath. The right nasal passage was freer, but the middle turbinate was hypertrophied and the septum deviated to the right.

A partial left lower turbinectomy, a submucous resection of the posterior portion of the septum and a partial right middle turbinectomy were performed. The pain completely disappeared after the dressings were removed. After complete relief for seven months, a slight recurrence of pain was noted when the patient became unusually fatigued. Rest will probably control this factor.

DISCUSSION

DR KARL M HOUSER When I was on Dr Frazier's service at the University Hospital ten years ago, I saw a number of patients who were sent in for avulsion of the sensory root of the fifth nerve. Most of them had had all of their teeth removed and in addition had had considerable intranasal surgery. Some of them received temporary relief after nasal surgery, but they had come to the hospital because of recurrence of their symptoms. Others, no doubt, had secured relief from such procedures and therefore did not reach a neurosurgical clinic.

DR GEORGE M COATES Fatigue seems to have been a definite cause of recurrence in this case. What does Dr Marshall consider the difference between major and minor tic douloureux?

DR GEORGE FETTEROLF Was there evidence of maxillary sinus disease in this case?

DR EDWARD H CAMPBELL Does Dr Marshall believe that the removal of a turbinate will relieve a vacuum type of headache?

DR MARSHALL The lowering of tolerance gives a minimal stimulus leverage. This patient improved and gained weight due to improvement in the nasal condition, plus rest. The pressure in the nose no longer exists and a vicious cycle is broken. A major case is one in which the ganglion itself is involved, whereas, a minor one is due to involvement of a branch of the ganglion alone. In this instance, there was pressure at the trigger-zone and also pressure in the vicinity of the ganglion due to turgescence. Removal of the turbinate influenced both types of pressure. It would have been proper to wash out this antrum, but there was no indication of involvement of the maxillary sinus. The factor of pressure was the impressive thing in this patient, and its removal was the procedure indicated.

OCURRENCE OF EOSINOPHILS IN THE MUCOUS MEMBRANE OF THE MAXILLARY SINUS IN ASTHMATIC PATIENTS DR GEORGE M COATES and DR MATTHEW S ERSNER

This article appeared in full in the February issue (11 158, 1930)

DISCUSSION

DR PHILLIP S STOUT The technician at the Jefferson Hospital asthma clinic has reported this condition for some years We have performed a large number of Caldwell-Luc operations on patients with asthma, but have found that although they were relieved, the symptoms eventually returned if we waited long enough There is a distinct relationship between eosinophilia and asthma as the person without asthma and the patient with asthma may both show eosinophilia Sinus disease never produces asthma in a person not allergic

DR J ALEXANDER CLARK A number of peculiar things occur in patients with asthma, none of which are constant Hypotension may be mentioned as one of these phenomena as well as eosinophilia It is a question whether eosinophilia has anything to do with asthma or whether it is just an accident In a large number of cases which we studied, only one third of the patients showed eosinophilia in the blood, while the others did not show it at all In hay-fever, there is no eosinophilia in the blood Occasionally from 50 to 60 per cent of the leukocytes in the sputum may be eosinophilic The Germans differentiate between true eosinophils and pseudo-eosinophils, regarding only as true eosinophils those with large granules

DR KARL M HOUSER What was the relationship of the eosinophils in the mucous membrane to the blood eosinophilia?

DR GEORGE M COATES There has been much dispute about the nasal factors in asthma Is hyperplasia the result of allergy or the cause of the allergic manifestations? That the nose has a specific influence in sensitized persons may be shown by removing a polyp or some hyperplastic mucous membrane The word "cure" is always a relative one, but many patients undoubtedly were relieved by minor intranasal procedures

Tobey, Emerson and Mosher have also found the eosinophils in their cases Our patients with asthma were relieved when the mucous membrane was removed What this means is difficult to say, but it is an interesting observation The occurrence of eosinophilia is so uniform in asthmatic sinus disease that it deserves some thought Emerson believes that in all cases of vasomotor rhinitis, there is disease of the maxillary sinus, and that an atrophic mucous membrane is just as important as a hyperplastic lining

DR ERSNER Recurrence is probably due to regeneration of mucous membrane or to damming up of secretions A peculiar slimy fluid is present in allergic persons Predisposition to asthma is a debatable subject The eosinophils were identified by Dr Kolmer We did not check the blood picture in our group of cases nor perform intradermal tests with the isolated organisms

LIMPHO-EPITHELIOMA OF THE TONSIL A BILATERAL CASE DR PAUL O SNOKE

Dr Snoke reported the case of a white woman, aged 60, who was well until December, 1925, when she noticed a sense of constriction and discomfort in her throat Simultaneously, a mass appeared in the left side of the neck at the angle of the jaw, which enlarged to the size of an egg in one month There was no history of acute intra-oral infection Results of a physical examination were otherwise negative at the time

The left tonsil was greatly enlarged, red and hard and the surrounding structures were indurated The tonsil crypts were dilated and clearly visible The right tonsil appeared normal In the left side of the neck there was a mass of glands over the carotid bulb The Wassermann test of the blood was negative

Following the introduction of radium seeds directly into the tonsil in January 1926 the patient remained well until January, 1928 when she developed severe headache and diplopia. There was a mass above and mesial to the inner canthus of the left eye involving the frontal bone and the frontal and ethmoidal sinuses. This mass displaced the left eye laterally. Several days later dysphagia developed. There was no dysphagia or hoarseness.

Laryngoscopy revealed a mass in the right pharyngeal wall at the pyriformo-esophageal junction which was submucosal. There were no palpable cervical glands. The chest was negative for metastasis as shown by the roentgenograms.

Ten days after radiation of the left frontal area and the left and right cervical areas the frontal mass had disappeared and the dysphagia was greatly relieved. A month later the patient complained of great dryness of the mouth and partial deafness in the left ear. Results of an examination revealed a mass in the left nasopharynx occluding the eustachian tube and another tumor in the left soft palate. Both of these masses resembled the orbital mass. Digital examination of the pharynx and the posterior third of the tongue was confirmatory except that the right tonsil was found to be stony hard normal in size and well circumscribed. It did not have the visual appearance of a neoplasm nor was there any ulceration but the hardness aroused the suspicion of the examiners and a biopsy was taken. Dr. Ewing agreed with the diagnosis of lympho-epithelioma saying: "It is difficult to distinguish many of these cases from lymphosarcoma. The clinical history helps and here the absence of nodes in the neck after two years tells against lymphosarcoma." This biopsy was taken from a normally appearing right tonsil, the left tonsil having been destroyed by radium in 1926.

The recurrence failed to respond and the patient died in June 1928. The significant points in the clinical course of this patient were: the duration of the disease for two and one half years; the location in the tonsil; the sensitive radiation response and sensitive metastatic response; the disease recurrence (not glandular) and the involvement of the opposite tonsil. The value of palpation of both tonsils in dealing with intra-oral neoplasia was stressed. The numerous areas of lymphoid tissue in the nasopharynx afford easy access to neoplastic cells and metastatic growth, visualization of which means relatively little without palpation.

DISCUSSION

DR. BERNARD P. WIDMANN. This is an intra-oral type of cancer so sensitive to radiation that it has been called lympho-epithelioma to differentiate it. Cancer of the alveolar process also responds well to irradiation and differs from the usual cancers of the squamous cell which are resistant to irradiation. Cancers of the mouth and especially of the tonsil are less accessible and therefore are more extensive before they are seen. The pharynx, tongue and peritonsillar tissue is involved by this time and we have to rely on irradiation alone. The early case is rarely observed. The Mayo Clinic classifies these tumors as lymphosarcomas because of the diffusing infiltration which occurs. The peculiar sensitivity of this type of cancer resulted in reclassifying it. Varying classifications are given by pathologists but the more highly cellular a cancer is the more sensitive to radiation and the more malignant.

Electro-coagulation causes slough, suppuration and pain so that seeds plus heavy external radiation to the physical limit of the patient and toleration of the skin, have been employed. If there is involvement of the gland the chance of cure is slight.

Surgeons until recently thought they could do a block dissection when involvement of the gland occurred in oral cancer. If the involvement was bilateral this was hopeless. Block dissection in the unilateral cases has given good results. We now feel that if there is surgical metastasis the case is inoperable. Many cases on record as cured cancer of the tonsils probably belong to this group. In this case metastasis probably occurred before treatment was instituted.

DR FIELDING O LEWIS This patient died of starvation. Were patients with esophageal involvement treated in a similar manner as those with other lesions? One patient treated at the Philadelphia General Hospital had tonsillar involvement but no peritonsillar extension. There was a palpable gland in the neck. He is still living six years after treatment. In many cases of cancer of the tonsil the patients have done well following radiation even when the tongue, soft palate and pharynx were involved. In one patient, the alveolus part of the tongue and the soft palate were treated first with desiccation and later with radiation with splendid results.

DR JAMES A. BABBITT A patient with lymphosarcoma of the tonsil at the Lankenau Hospital received external cross-fire radiation. With the disappearance here, a swelling appeared in the superior carotid triangle of the neck. This was also treated with radiation. Later a careful dissection was made by Dr. Deaver but in a few days general metastasis, especially to the mediastinum occurred and the patient died.

DR SNOKI The pathologist is playing a large role in determining the degree of treatment. We need standardization of pathologic classification. Some of these patients get well. Those who die do so in a two year interval. In this case radiation was applied over the esophageal region. We now regard it as unwise to interfere after a hard, fibrous mass appears following radiation. We always persuade the patient not to have further interference as this leads to metastasis and a vicious recurrence.

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Regular Meeting, Nov. 4, 1929

THOMAS C. GALLOWAY, M.D., *Vice-President, Presiding*

HEMANGIOMATOUS TUMOR OF THE TYMpanic DR. FRANCIS LEDLER

Mrs. F. A. Z., aged 53, was first seen on Aug. 23, 1929, complaining of a pulsation in the right side of the head, pain in the neck and head of about two years' duration and impaired hearing of three years' duration. Her symptoms had become progressively worse, and included a sort of quivering, jerky sensation in the face. She said that several physicians had opened what they termed a "blood blister," and each time a severe and almost uncontrollable hemorrhage followed. Her general and family history revealed nothing of importance, and the laboratory and physical observations were negative. She had never had a discharging ear.

Examination of the right ear showed a large, purplish, granulomatous-appearing mass in the canal on the posterior inferior wall, anterior to the tympanic membrane. This mass was quite firm and did not pulsate. There was, however, visible vascular pulsation in the region of the attic. On auscultation with a diagnostic tube, one end in the patient's ear and the other in the examiner's ear, a definite bruit that corresponded to the patient's pulse as well as to the rhythm of her subjective pulsation could be heard. The tuning fork tests indicated only a marked involvement of the middle ear; the whispered voice was heard at contact.

Roentgenologic examination revealed a "possible rarefied area in the right mastoid."

Examination of the eye by Dr. Emil Deutsch showed a marked blepharospasm of the oscillating type involving the upper lid, not the eyebrow. The spasm was more marked on the lower lid, extending to practically the entire right lower two thirds of the face, the upper and lower lids being drawn outward during the spasm. The patient said that these spasms were periodic, lasting from five to twenty minutes and perhaps not recurring for hours. The right palpebral fissure

was wider than the left, being 8 mm and the right 15 mm. There seemed to be a slight proptosis of the right eye. Measured with Hertel's exophthalmometer, the right eye was 14, the left 13. The extrinsic muscles were normal. Observations on the media and other observations were negative.

Examination of the fundus showed no pathologic changes. Vision with the correction was 20/20.

A tentative diagnosis of angioma of the tympanic membrane was made, and Dr. Joseph C. Beck was called in consultation. He concurred in the diagnosis and advised an exploratory operation. On Sept. 7, 1928, with the patient under general anesthesia, Dr. Lederer carried out the technic of a radical mastoid operation until he reached the posterior bony canal wall, where considerable bleeding from the mass in the canal was encountered. The mastoid cells were normal but the fluid contained in each was seen to pulsate. As the posterior canal wall was taken down at the bridge a soft mass was encountered in the middle ear which bled so profusely that the cavity was immediately packed. The dura of the middle fossa was exposed in order to ascertain the origin of the mass and there also profuse pulsatory bleeding was encountered. In order to eliminate packing, a plastic operation on the canal was done according to his usual technic.

The histologic appearance of the tissue removed was that of a cavernous angioma. It was impossible to remove extensive portions because of the uncontrollable bleeding, but Dr. Lederer believed that he was dealing with a hematoma. According to the history this was not a new formation and fitted in with a congenital malformation similar to a vascular nevus.

On the fifth postoperative day, the patient developed a facial palsy on the side on which operation was performed. Any attempt to remove the pack caused profuse bleeding and not until the tenth postoperative day was it possible to substitute a smaller pack. The facial palsy gradually cleared up and the patient left the hospital, but was observed at frequent intervals. She was relieved from the marked pulsation but the tendency to bleed persisted to such an extent that epidermization was permitted to occur just inside the meatus of the external canal in order to protect the tumor mass.

At the time of the report, the twitching of the face persisted and the pulsatory bruit could still be elicited with the diagnostic tube.

DISCUSSION

DR. OTTO STEIN. I saw this patient before and was impressed by the dramatic aspect that a case of this type presents from the diagnostic standpoint. The appearance of an ear of this kind is often that of a blue drum membrane and is mistaken for fluid within the middle ear. If one is not careful in the diagnosis one may incise a mass of this kind and meet with alarming and possibly uncontrollable hemorrhage. A blue drum membrane is often difficult to diagnose. It is sometimes due to fluid in the cavity and sometimes to bulging of the jugular vein. The type of case presented by Dr. Lederer did not offer this difficulty, but one should be careful not to attempt incision.

DR. ROBERT H. GOOD. I was reminded of a patient who was under my care several years ago. The case was one of mastoid infection with necrosis in the region of the antrum and of the tegmen. I used packing because of the severe hemorrhage, and about fifteen hours later the nurse reported that the patient was paralyzed in one leg and arm. The blood had gone extradurally into the temporal region. With the patient under anesthesia I quickly did a decompression operation, which relieved the paralysis, but the patient died from uncontrollable hemorrhage. I do not know whether the case was one of angioma or not, but there was necrosis of all the bony tissue in the tegmen.

DR. FRANCIS LEDERER. I attempted coagulation by surgical diathermy but every time the bleeding was stronger. This patient also has suffered from several spontaneous hemorrhages.

The question was one of etiology. Whether it occurred from gravity or whether it was a telangiectasis I do not know, but the condition was annoying.

for both the patient and the physician. The one thing that operation did in this instance was to insure the patient against spontaneous hemorrhage because there was then a web of epidermis across the canal, which protected the bluish hematoma which could still be seen.

HOW PHYSICIAN AND SOCIAL WORKER UNIT TO SOLVE THE MODERN HEARING PROBLEM DR WENDELL C PHILLIPS

Dr Phillips spoke of the origin of the efforts at rehabilitation which began before the World War and called attention to two categories of the disabled because of deafness, one in which the defect was stationary and the other in which it was progressive. He mentioned thirty-six states in which vocational training is provided for these people through bureaus. The otologist finds a mechanism for the rehabilitation of the deafened in the American Federation of Organizations for the Hard of Hearing, which embraces seventy organized groups in the United States and Canada. These organizations are developing a personnel, almost all of whom are deafened, of social workers for this special work. None of the organizations includes work for the congenitally deaf but they are in cordial agreement with the objectives of such societies as the American Federation to promote the teaching of speech to the deaf.

He pointed out that the federation had adopted a program of public education and information, aiming to check the development of progressive deafness. It is also promoting and undertaking surveys of schools to discover incipient cases of hearing impairment. Twelve per cent of the elementary school children were found to have some defect in hearing. Dr Phillips said that he looks with confidence to the future in this program to check the development of serious deafness.

MUTUAL RELATIONSHIP BETWEEN THE OTOLOGIST AND THE LEAGUE FOR THE HARD OF HEARING DR HAROLD HAYS

Dr Hays said that for fourteen years he had been vitally interested in the social and economic handicap under which the deafened person lives. In 1912 working at the New York Eye and Ear Infirmary, he tried to inquire as to what the deafened persons did and what happiness they derived from life.

The New York League for the Hard of Hearing was formed, with the alumnae association of Mr Edward Nitchie's school as the base. The league gradually gained in momentum and after the World War they were able to engage the enthusiasm of Dr Phillips, in 1921, the American Federation of Organizations for the Hard of Hearing was started. There was some suspicion at first as to what this organization was to do, but during that year Dr Phillips and Dr Hays formulated a constitution and by-laws, enlisted the cooperation of the American Medical Association and secured the assistance of a number of otologists. The league could never succeed in any community without the cooperation of the otologists in that community.

There are two things to consider: first, how much assistance the otologists can give to the league, and second, how much the league can give to them. Otologists receive far more benefit from the league than they ever can give to it, when they find out what is being done and how they can cooperate. In New York City the otologists find many hundreds of patients for whom they can do nothing. Not 1 case out of 1,000 is otosclerosis. If a patient has an advanced degree of deafness and an examination shows that little can be done, the patient should be informed that his deafness is of such nature that little can be done medically, but that if he places himself in the hands of a competent otologist he can perhaps keep him from becoming worse. Such patients should be told to have their ears tested twice a year and should be assured that they can add greatly to their happiness if they will help themselves, and will acquire mental readjustment so that they will realize that life is worth living. In New York such patients are sent to the League for the Hard of Hearing to become reestab-

lished mentally and to ask them to try various hearing devices which the league has on exhibition to find out which is the best for the individual case. They are requested to find out what lip reading will do for them. They are also made to realize that there are many hundreds of little children who need help and this cannot be obtained unless they lend their cooperation.

Dr Hays felt that every otologist in the United States should be told of the wonderful work that the American Federation of Organizations for the Hard of Hearing was doing, and that they should be urged to cooperate with such an organization in their own town. It has been difficult to make otologists realize that this work is worth while for themselves as well as for their patients. Three years ago the American Medical Association appointed a committee with two men from each state as members to study this question, mainly the prevention of deafness. No concerted effort has been made to accomplish any particular thing but these men have been deluged with literature from the federation, and Dr Hays felt that eventually a proper interest will be awakened.

The work of the league was concerned largely with the adult hard of hearing, but this has turned, to a great extent, to the prevention of deafness in children, for 8 or 9 per cent of the children attending public schools are sufficiently deafened to need thorough examinations. Dr Fowler has a splendid clinic in New York City. There children are investigated thoroughly from all standpoints, and infections are cleared up. Dr Fowler has not been able to get the cooperation of the physicians in New York City, and Dr Hays realized that it is a problem they should help solve.

The phono-audiometer can be used in the public schools, so that forty children can be examined at one time and those who need more careful tests can be weeded out. In Detroit there is a school for the deafened, and an eminent otologist there has cooperated with the school since its earliest existence. Not only hearing but also mental tests are made. The intelligence test will often show a mental co-efficient above normal, and if the hearing of a child is improved by attending a special school and learning lip reading it frequently happens that they can be returned to their normal school at the end of the year. Dozens of children are brought to the clinic in New York City many of whom need instruction in lip reading while others need medical treatment. Excellent results can be obtained by careful observation and treatment. Dr Fowler has treated more than 200 children in three years. The children are divided into two classes, those with suppurating ear and those with catarrhal deafness. More than 60 per cent of the patients have been improved. The league has a large board of consulting otologists, and if the patient cannot afford to pay, any one of these physicians will make an examination and report to the league.

Dr Hays felt that this problem must be met in a personal way, and that every member of otologic societies everywhere should be willing to cooperate with the American Federation and local league. The committee on the hard of hearing of the American Academy of Ophthalmology and Oto-Laryngology recently met to determine how to arrange for one central committee of the various national societies. They felt that if the otologists of the country would work along certain definite lines the coordination of effort would accomplish a great deal.

A standardized method of testing hearing is essential. This can be done only by having a standardized instrument which all otologists will use. Such instruments are obtainable, and the interchange of accurate records will be of great value.

Those who have been working along this line for several years believe that the time is coming when it will be possible to improve the condition of the deafened adult and the deafened child, and that some cases can be prevented by proper attention and some patients even cured. Much has been accomplished in the realm of physics mainly by the cooperation of the Bell Telephone laboratories in interpreting types of deafness and perfecting apparatus. But, up to the present, the medical profession has done little. Dr Hays sincerely hoped that the otologists will soon realize that preventing deafness is equally as important an accomplishment as operating on a patient with a virulent mastoid infection.

DISCUSSION

DR GEORGE E. SHAMVAUGH. I believe that most human happiness can be credited to humanitarian ideas, which are shared by most people, but very few have the ability to formulate plans to put these ideas into execution. Otolologists have always desired to do all they can for the deafened but the first consistent effort to work out a helpful scheme for rehabilitation was accomplished by Dr Phillips in formulating the League for the Hard of Hearing. The league is of great assistance to every otologist, who is now able to tell the patient afflicted with incurable deafness not that they have an affliction for which nothing can be done but rather that through the League the door is opened to them for rehabilitation. The otologist has his own problems which do not include the social work of rehabilitation teaching lip reading is well as the economic and social problems for these people. I would be at a loss in practicing otology without the assistance that comes from the league. I agree with Dr Hays that most of the children who have defective hearing can be benefited, and that many of them can be cured by treatment. The reason is that most of these children owe their defective hearing to tubotympanic trouble, a condition that can be readily relieved. An important question is in how far do these conditions in childhood predispose to the development in adult life of the condition that is known as progressive deafness, or otosclerosis? I am of the opinion that progressive deafness of adults is not the sequel of the tubotympanic processes so common in childhood. Otosclerosis rarely begins during the first decade. The number of persons suffering from deafness as the result of otosclerosis, is considerable. I am convinced that it is not the rare condition which early otologists believed it was, and this view of the incidence of otosclerosis is today shared by those who have been most interested in this problem. I think that Dr Hays touched on an important question when he discussed the manner in which the matter should be presented to patients. Great tact is necessary. The facts can be told in such a way that they do not greatly shock the patient. It is rather the exceptional case of otosclerosis which proceeds to the point of severe or total deafness. Bezold pointed out long ago that many of these cases go for long periods apparently without any change. These facts should be pointed out to patients who are inclined to be depressed. They should also be told that the progress of the deafness is much more likely to be influenced by conditions of general health than by anything that is done locally to the nose, throat or ears. These people should also be warned that in all of our large centers are men, graduates of medical schools, who are willing to prey on the helplessness of these persons and encourage them to allow them to carry out foolish and bizarre methods of treatment which they should know cannot possibly influence the process that is causing their trouble.

DR OTTO SHINN. I believe that the subject is not discussed sufficiently in medical societies in general. I have found that otologists suffer from a marked degree of apathy so far as the hopeless side of deafness is concerned, and seem to be indifferent toward making any effort to assist these patients. I have taken a great interest in the League for the Hard of Hearing, and think that without their assistance I would often leave my patients stranded. They are greatly benefited when they become acquainted with and join the league.

Not long ago in discussing this subject at a dinner one of the prominent men in the city said that he thought there was a tendency on the part of the league to interfere with the practice of medicine, that it rather smacked of state medicine and he was against it. I fear that this feeling exists with others because they are not aware of the real situation, and do not trouble themselves to find out what splendid assistance the league gives.

DR JOHN J. THIOBAID. I have been engaged in detecting the hard of hearing rather than in the reeducation. I have examined with the whispered test about 30,000 school children under the auspices of the Chicago league and have found about 3 per cent to have definite hearing defects. Considering that there are about 500,000 school children in Chicago and that it has taken six or seven years to examine 30,000 it is apparent that much remains to be done. The examina-

tions, while slow, were rapid enough to keep pace with the follow-up work. We did not have the advantage of an audiometer until the last school was examined recently. At this school we used the 4 A audiometer, and also the whisper test method. Comparative results will be published soon. Audiometer reports vary from 2 to 16 per cent. This variation is too great and there is urgent need for standardization. One has to be careful to avoid such high percentages by rechecking, for when children not clinically hard of hearing are sent to clinics or to their physicians they are often returned with a negative diagnosis and this discredits the work, for parents want to hear that their child is normal. With the whisper test and tuning forks about 52 per cent of the patients were found to have tubo-tympanic catarrh and were greatly benefited by inflation. Patients with advanced cases of catarrh who could not be benefited by inflation were advised to learn lip reading. I think that it would be excellent if children could take part-time instruction in lip reading as an adjunct to their other school work, when the present defect is not sufficient to warrant full-time instruction. Instruction in lip reading should be urged in all cases in which one decides that there is a progressive form of deafness.

Besides chronic catarrhal cases, this group includes bilateral chronic suppurative otitis media, otosclerosis and some cases of nerve degeneration. One must not be misled by the apparently fair hearing ability in a child suffering from the progressive conditions mentioned. One must think rather of the almost inevitable loss of hearing over the ensuing period of from ten to twenty years despite all forms of treatment.

The League has not been able in the past to arouse much enthusiasm in Chicago in regard to the introduction of routine examination in the schools, although since the advent of the 4 A audiometer there are definite signs of activity. I have recently been informed that the Chicago school system contemplated getting three of these instruments and going into the examinations on a large scale. This was gratifying news to the Chicago League for the Hard of Hearing and to the medical profession in general as it is the beginning of the solution of an old problem.

The medical profession is indebted to Dr. Phillips and Dr. Hays who have been directly responsible for the formation of the leagues for the hard of hearing, who in turn have provided the stimulus for routine examination of school children.

DR J. HOLINER. Splendid work is being done by the League for the Hard of Hearing in Chicago, and I commend the great responsibility of the physician who handles these patients. Many of the patients become desperate and attempt suicide when they are informed that they have progressive deafness and that nothing can be done. It is not the otologist alone who should be informed about this work, but the general practitioner who sees the patients in the early stages of deafness, and often does nothing for them beyond advising the use of "sprays" for the nose. If they get a better understanding of these cases and realize the seriousness of delaying proper diagnosis and advice, much more can be accomplished for the patients. Most of the physicians do not realize that they are neglecting these patients cruelly.

I believe that Dr. Hays must be mistaken when he says that not in 1 of every 1000 cases in which the diagnosis of otosclerosis was made by otologists was this diagnosis correct and could it be verified by pathology. I insist that the opposite is true, namely, in every case in which the diagnosis of otosclerosis was made in the living according to the teachings put down by Bezold and Siebenmann. The characteristic changes were found in the dead. Before Siebenmann cleared up the situation, it was believed that a large part of the disease was due to changes in the blood vessels, because of the loud thumping noise synchronous with the pulse. Therefore Siebenmann worked out his beautiful atlas of the blood vessels of the labyrinth.

DR ALFRED LEWY. Is there an electric device in this country that is especially fitted for deafness of the inner ear? I believe that most of the amplifiers as now made are unsuitable for this condition. Professor Flatau presented an instrument

before the German Otolaryngological Society that is alleged to damp lower tones, to amplify higher ones and to be of aid in deafness of the inner ear

DR G HENRY MUNDER I think that the question of sending these patients to physicians was interesting and brought up a point which might well be considered. There is a strong tendency among many physicians to agree with parents that there is nothing wrong with a child. I believe that it might be possible to prepare a statement that could be printed on the back of the examination blank stating that the child had shown a certain percentage of deafness. The same thing applies to deafness as to strabismus in young children, but it is difficult to make people understand that these conditions should be treated during early childhood. I have had an unusual opportunity for observing these children, for I lived next door to a school for the deaf for several years. I believe that only a person who has seen these children develop can really understand what they get and what they can get out of life. No otologist can follow his deafened patients unless he makes audiograms frequently.

I consider the League for the Hard of Hearing the type of organization that the medical profession would be pleased to work with, and suggest that some effort be made by the Society to broadcast to the general practitioners something of the scope of the work, and the opportunity really to serve these patients. Several times a year I see young children who are undoubtedly deaf and those are the cases on which I spend the most time. I talk to the parents and make them understand that the child should be placed at once where its education can be started instead of waiting until it is grown or half grown, as so many practitioners advise.

DR AUSTIN A HAYDIN I express my appreciation of the presentation of this subject and my interest in the discussion. I hope that the habit of willing temporal bones to physicians will increase, particularly if the bones are accompanied with a detailed history of the case from its inception. Not until a number of such cases have been obtained can a comprehensive study be made and recorded.

I believe that the discussion of the papers could be summed up in two things. 1. Otolologists should cooperate with the League for the Hard of Hearing. If the problem of the deaf and the deafened is to be solved by the proper people, the medical profession must contribute a large share of the effort, and must guide the work and interests of these persons into proper channels or great harm will be done to the deafened today, and a great opportunity will be taken away from those who are to come. The society owes a great debt of gratitude to its council of last year in the fact that the council adopted a resolution by which every member of the society was automatically made a member of the Chicago League for the Hard of Hearing. I believe that this plan should be put in force all over the country, so that each otologist would become an integral part of the leagues for the hard of hearing.

2. I believe that otologists must come to standardize the measurement of hearing defects. One will agree that much of the work Dr. Theobald has done, much of the excellent work Dr. Shambaugh pioneered in and the work Dr. Hagens had assisted with in the institutions would have been more valuable if the tests had been made with the 4 A audiometer than with the whispered test. The same thing is true of the otologist in the office. They should use not only the 2 A but also the 4 A audiometer, and should standardize the whisper test.

There is a great deal to be done for the deafened by the medical profession and in return perhaps some things that they can do for the physician. Every otologist should be vitally interested in the problem that affects such a large percentage (perhaps 10 per cent) of the population.

DR A M CORWIN I was impressed with the fact that every otologist should broadcast to his own conscience the fact that in the League for the Hard of Hearing there is a body of specialists who are doing work that the medical profession never has done and never will do for they do not know how to do it. It is a most important thing for these handicapped persons, and it is the duty of every physician to refer the deafened to the laboratories of the League for the

Hard of Hearing The sooner they realize that there are laboratories with which they can cooperate and that they are doing excellent work the better will be the progress

DR WENDLLI C PHILLIPS Before making any attempt to educate the general practitioner as to what his duty is, the otologists of the country should be educated Few of them have any idea of what is needed, and I believe that the Chicago society could consider itself far in advance of the general run of otologists

It is necessary to solve the problem of deafness, whatever type it may be I am in accord with the work of the American Otological Society and that of the other societies that study temporal bones, and am in full sympathy with the work among the deafened children Some time the problem will be solved, it may be in the laboratory through the study of temporal bones, or it may be through the study of the diseases beginning with the young children I am more inclined to think through the latter

As to electric hearing aids, there are certain deafened persons who can never hear with an electric device Very old persons who are almost totally deaf rarely can hear through such a device I have seen few cases of absolute deafness, but recall one hopeless case in which the patient was totally unable to hear any sound

DR HAROLD HAYS I appreciate Dr Shambaugh's remark and his sympathy with the work the leagues are doing

I agree that although many cases have proved to be otosclerosis by laboratory investigation, many persons are down and out because this diagnosis has been given them when it was later proved that the deafness was due to something entirely different The greatest bugbear today is this diagnosis Patients are afraid of the term otosclerosis and they do not believe, as Dr Shambaugh does, that such a condition can be improved I do not claim to know any more about otology than anyone else, but I believe that many cases have been diagnosed as otosclerosis which showed a deafness due to a relaxation of the ear drums or to some systemic toxic factor

MENINGITIS (STAPHYLOCOCCUS AUREUS) SECONDARY TO SINUSITIS WITH OPERATION AND RECOVERY DR HOWARD C BALLENGER

A number of recoveries from meningitis have been reported in the literature but when the diagnosis of a suppurative meningitis has been substantiated by the recovery of the causative organism in two or more lumbar punctures, the number of reputed recoveries is greatly lessened

Kolmer, in writing of pneumococcic and streptococcic meningitis, said that "the mortality of diffuse spreading types with purulent cerebrospinal fluid is nearly 100 per cent"

Neal, in 1914, found only five cases of recovery following streptococcus meningitis Lamar, in 1912, collected reports of thirteen cases of pneumococcus meningitis in which cure resulted Eagleton, in 1912, in an analysis of the literature of reported recoveries from suppurative meningitis in which the diagnosis was substantiated by finding organisms in the cerebrospinal fluid, found only thirty-one cases (including his own) Six of the thirty-one cases were somewhat doubtful of being meningococcus or were without sufficient data to prove clearly that they were suppurative meningitis

Goldstein and Goldstein, in 1927, after a review of the literature, estimated about 150 cases of recovery from pneumococcus meningitis

The reference in the literature to staphylococcus meningitis is rather meager, probably due to the comparative infrequency of its occurrence

Neal, in 1924, examined a list of 1,535 cases of purulent meningitis The causative organisms in the order of frequency, were meningococcus pneumococcus streptococcus influenza bacillus, staphylococcus and *Bacillus coli* Cases due to the last two organisms were found to be comparatively rare

There seems to be a general impression that a purulent meningitis due to a streptococcus is more virulent than one due to a staphylococcus. Perusal of the literature fails to offer evidence for, or against, this impression. Dandy attributed more importance to the virulence of the organism than to its type. Recoveries from staphylococcic meningitis have been reported by Dandy, Moise, Lortat and Grivot, Sakini, Emerson, Wharry and probably others.

Records of Children's Memorial Hospital—An examination of the records of the Children's Memorial Hospital for the years 1909 to August, 1929, of all cases of meningitis (exclusive of tuberculous meningitis) reveals a total of 297 cases, 273 of which were epidemic meningitis leaving 24 cases (excluding my own) of septic meningitis. All but 1 of the 24 patients with septic meningitis died in from one to fifteen days. This patient (no. 2) was taken from the hospital without permission in a dying condition.

The various white blood cell counts were recorded in 14 cases. They varied from 3,250 to 58,800, giving an average of approximately 22,000.

The cell counts of the spinal fluid taken by lumbar puncture were recorded in 19 cases (1 case marked "mny"). They varied from 210 to 14,400 cells. An average of these counts gives a figure of about 3,800.

A culture of the spinal fluid was recorded in 23 cases. An organism was obtained in one or more cultures during life in 21 cases. In the 2 cases in which an organism was not demonstrated during life, an organism was obtained from a culture taken at autopsy. A streptococcus was responsible in 13 instances. A pneumococcus was found in 10 cases.

A culture of the blood was recorded in 5 cases. In 4 instances a positive report was obtained. All the positive blood cultures showed the same organisms that were found in the spinal fluid.

R. L., a boy, aged 6 years entered the Children's Memorial Hospital (Chicago) on Aug. 17, 1929 complaining of headache, fever, convulsions and swelling of the forehead and left eyelid.

The illness began two days before admission with a frontal headache and a purulent discharge from the nose, worse on the left side. His nose had been discharging mucopurulent secretion for the past month. He was said to have had sinusitis. The day before admission he began to have some swelling above the bridge of the nose and the midline of the forehead, accompanied by a high fever. In the evening he began to jerk and soon to convulse generally. These convulsions lasted about two hours until relieved by packs and chloral. No vomiting occurred.

The past history was unimportant except that one month before presentation he had an attack of diarrhea and vomiting.

The physical examination revealed a well nourished child who was irritable and febrile. The ears, chest and abdomen were normal. A diffuse, brawny, tender swelling without redness or fluctuation, was present over the middle and lower portions of the forehead and the upper part of the nose and left upper eyelid. Rigidity of the neck was present. Brudzinski's sign was absent. The knee reflexes were not elicited. Kernig's sign was positive. Babinski's sign was not constant and ankle clonus was not present.

The blood count showed 16,400 cells, 88 per cent polymorphonuclears and 12 per cent lymphocytes.

The spinal fluid was turbid and under moderate pressure with a 2 plus Pandy test. The cell count was 320 with 96 per cent polymorphonuclears and 4 per cent lymphocytes. Culture of the spinal fluid taken at this time showed gram-positive staphylococcic which on further growth proved to be *Staphylococcus aureus*.

The following day the patient's condition was worse with increased stiffness of the neck and increased swelling and tenderness of the forehead and upper left eyelid. He was irrational at times. Positive Brudzinski and bilateral Kernig signs were present. Ten cubic centimeters of concentrated antimeningococcus serum was given.

The following day (August 19) I saw the child in consultation with Dr. P. F. Morf and Dr. G. P. Weiler who had referred the patient to me. As his condition

was growing worse and signs of the meningitis were increasing, it was decided that he might have a slim chance if the left frontal sinus was opened externally with removal of the inner bony table to establish drainage from the probable point of entrance of the infection to the meninges. This was done the following day. The left frontal sinus was filled with a thick yellow pus. The mucous membrane lining the sinus was detached and appeared to be partly destroyed. After the inner table of the frontal sinus was removed, the same yellow thick pus escaped from the dura with a more or less continuous flow. Culture of this pus revealed *Staphylococcus aureus*. The right frontal sinus was opened by removal of the septal wall that separated the two sinuses. Pus was also found in the right frontal sinus. Cigaret drains were stitched into the wound, one drain going to the right frontal sinus and another to the dura. The wound was not closed. Lavage of the brain was not used at operation or subsequently. The general postoperative condition was good.

Cultures taken from the frontal sinus, dura, blood and nose at various times all showed *Staphylococcus aureus*.

Three days after the operation pneumonia developed in the left lower lobe with later involvement in the right axillary region. The pneumonia was probably of a metastatic or a hypostatic type.

A day or so later a profuse discharge of pus was obtained from beneath the outer portion of the upper eyelid, probably a burrowing of pus from the left frontal sinus. The spinal fluid continued to show the staphylococcic organisms (with one exception) each time a spinal puncture was made up to and including September 11 (three weeks after the operation).

The cell count varied from 260 to 3,350. In the instance in which the cell count was 3,350 the polymorphonuclear cells were 94 per cent and the lymphocytes 6 per cent, which was about the proportion held throughout, with a slight relative increase in the lymphocytes at times.

The highest white blood cell count was 32,400 which was taken on August 25, five days after the operation.

On September 3, two fluctuating elevations, about the size of a dollar, developed over the occipital region and over the parietofrontal region, which on incision proved to be abscesses containing a large amount of thick yellow pus. A pure culture of *Staphylococcus aureus* was obtained from each abscess. A few days later a third abscess occurred in the left parietal region which also showed *Staphylococcus aureus*. Roughened bone could be felt under each abscess. The abscesses were probably due to an osteomyelitic process. One abscess is still draining with a diminishing discharge at the present date (November 1).

In the three instances in which blood cultures were taken, positive cultures of *Staphylococcus aureus* were obtained twice. The first negative blood culture was found nineteen days after the operation.

The patient was in a semicomatose state, drowsy and irrational at times during most of his illness with occasional attacks of vomiting. Headaches were complained of frequently. Many times he would awaken with a loud cry (meningeal cry).

On September 11, or the twenty-first postoperative day, he suddenly developed a complete paralysis of all the muscles of the right eye with a dilated pupil which did not react to light. He could count fingers in this eye and later could read large type. There was some question whether or not a slight choking of the disk was present. The paralysis of the pupil and the muscles of the right eye had continued to the time of presentation with some improvement. All evidence of sepsis, however, had disappeared. He had no other evidence of a mental or physical defect with the exception of a slight discharge from one of the abscesses on the scalp (November 1). In summing up this patient presented the picture of a double frontal sinusitis with suppurative meningitis (*Staphylococcus aureus*) complicated by bronchopneumonia and multiple abscesses of the scalp probably of osteomyelitic origin, with septicemia, drainage of the brain through the probable site of the infection and recovery.

DISCUSSION

DR J. HOFINGER Is there any experience which might give information as to whether in the early use of the serum in epidemic cerebrospinal meningitis there might be fewer cases of subsequent total deafness? This question was prompted by an experience in the Alexin Brothers Hospital a number of years ago. Four boys of the same family were brought in with cerebrospinal meningitis. They received the serum as soon as possible. One boy died and the other three were discharged with beginning deafness. One physician told the mother that the boys would be all right, but I told her that I thought that all three would be deaf, and so it happened. I want to know whether it is the general experience that deafness does not occur if the serum is used early and how early it must be used.

DR J. C. GALLOWAY I am interested in this report and appreciate the courage of Dr. Ballenger. It should make the medical profession appreciate the possibility of curing such a patient no matter how hopeless the case might appear. I recall three cases that were reported from the Cook County Hospital several years ago of progressive meningitis in which the physicians would have been justified in doing nothing but in all three cases recovery was obtained.

DR HARRY L. POITLOCK A somewhat similar case occurred in which the patient recovered without operation. The patient was a boy aged 12, on whom an ethmoid operation had been done during an acute cold. The boy was ill, had pus in the nose and a physician curetted out his ethmoids at home, with the aid of a lamp. The boy was brought to the hospital with the symptoms of an ordinary meningitis. The cell count was 1,200 on the first day, and all other tests were positive. There was no evidence of an ethmoiditis except thickening and secretion in his nose. The tissue was shrunk, the secretion was sucked out and a spinal puncture was done twice a day, all the spinal fluid that would come out being removed each time. This was done for fourteen days, and the staphylococcus was recovered in the fluid. No serum or anything else was given, only the spinal drainage. A neurologist saw the patient and suggested making a cisternal puncture and nothing else except a little sedative in the beginning to quiet the patient. At the end of three weeks he recovered. He had been watched since and there had been no permanent damage.

I congratulate Dr. Ballenger on his effort and on the splendid results he obtained.

SODIUM IODIDE IN HYPERESTHETIC RHINITIS DR ALFRED LEWY

For about two years I have been using with considerable success free iodine solution derived from sodium iodide in the treatment of patients with hyperesthetic rhinitis. I have followed the method recommended by H. Sternberg and M. Sugar (*Ztschr. f. Hals-, Nasen- u. Ohrenh.* **15** 357, 1926), who reported favorable results in acute and chronic nasal discharges and in hyperesthetic rhinitis from the use of the halogens in free solution. The technic with iodine is as follows: A 3 per cent solution of sodium iodide is prepared, sterilized and allowed to stand several days in a clear white glass stoppered bottle until free iodine appears. One cubic centimeter of this solution is injected hypodermically. There is sometimes a temporary exacerbation of the symptoms. The injection is not repeated until after five days. After the solution has stood for several weeks, its injection becomes painful because there is too much free iodine, which is also shown by the increasing yellow coloration. The solution should be discarded and a fresh solution prepared.

If the result is favorable, the injections are repeated as necessary. Most of my patients have had recurrences requiring occasional repetition of the treatment, but some appear to be permanently relieved. Several patients have been relieved by this method after a careful study of allergic reactions and various local treatments had yielded no results. I have also had some favorable results in the initial stages of acute coryza.

In a more recent article, the same authors recommend a 0.3 per cent solution of sodium iodide for patients in whom the 3 per cent aggravates the condition or brings no results. I have tried this twice on patients for whom the 3 per cent solution was ineffective. One of these promptly improved, the other was not helped. With the other halogens, I have had no experience.

MILK OF MAGNESIA AND OLIVE OIL AS A TOPICAL APPLICATION TO MUCOUS MEMBRANES. DR. ALFRID LEWY.

Equal parts of milk of magnesia and olive oil have been used by dermatologists for some time for skin irritations, but I have not known of the use of such a solution for acute inflammations of the nasal mucosa. For some months, I have been using this combination with satisfaction to my patients and to myself. There may be added to this base any of the essential oils, singly or in combination as desired. My favorite combinations are 15 or 20 drops of oil of white pine or of eucalyptol to the ounce of the mixture, this solution appears to be quite stable, but requires occasional shaking. It is especially useful when discharges are excoriating. In subacute inflammations of the nasal mucosa, I have used equal parts of compound fluid extract of benzoin, milk of magnesia and olive oil. Such combinations appear to me to be more satisfactory than any silver salts that I have used, but have the disadvantage of not being applicable through the ordinary medicine dropper for home use. For this purpose, I have used a 1 drachm syringe with a large opening and a heavy rubber bulb. It may be that the preparation will work well in a collapsible tube.

Book Reviews

OTOLOGIC SURGERY. Revised by SAMUEL J. KOFFETZKY, M.D., F.A.C.S. Second edition. Price \$8.00. New York: Paul B. Hoeber, Inc.

The first edition of this work appeared in August 1925, and was reviewed in the ARCHIVS OF OTOLARYNGOLOGY in the issue of February, 1926.

Surgery represents a relatively small part of the work which the otolaryngologist undertakes to do, albeit it may often represent the most important part of the work. Surgery of the ear is best understood when viewed from the standpoint of a trained otologist for it is only from this standpoint that one can get a proper perspective of the indications for operative intervention. The clinical problems of otologic work are not simple and they require an extensive background in clinical experience to be understood and evaluated properly. Too often textbooks on otology present merely a compilation of surgical hints and suggestions and show very little evidence that the author has acquired any clear insight into otologic problems. The surgical hints and suggestions are in themselves crude and could be much better stated by a general surgeon who has acquired only a smattering of technic in this special field.

The author of this work brings to his problem a carefully trained mind and a clear understanding of the problems with which the otologist is confronted. The book is a valuable addition to the library of the practicing otologist.

THE NECK. By PERCY D. HAY, JR., M.D. Volume IX of Annals of Roentgenology. Edited by James T. Case, M.D. Price, \$8.00. New York: Paul B. Hoeber, Inc.

This is the ninth volume of a series. The first volume, "Mastoids," was reviewed in the ARCHIVS in December 1929.

This volume on the neck covers a field in which the otolaryngologist has an interest. The volume includes roentgenograms of the normal conditions varying with age and sex, together with a variety of pathologic conditions including foreign bodies. The illustrations are well reproduced and will assist the student materially in gaining a background in experience so essential for the correct interpretation of roentgenograms. The volume contains sixty-six roentgenograms.

Directory of Otolaryngologic and Ophthalmologic Societies *

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Robert C Lynch, Maison Blanche Bldg, New Orleans, La
Secretary Dr Gabriel Tucker, Bronchoscopic Clinic, University Hospital, Philadelphia
Place Detroit Time June 23-27, 1930

AMERICAN BRONCHOSCOPIC SOCIETY

President Dr Thomas E Carmody, Metropolitan Bldg, Denver
Secretary-Treasurer Dr Louis H Clerf, 128 S 10th St, Philadelphia
Place Atlantic City, N J Time May 27, 1930

AMERICAN LARYNGOLOGICAL ASSOCIATION

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Place Swampscott, Mass Time May 22-24, 1930

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Secretary Dr R L Loughran, 33 E 63d St, New York
Place Atlantic City, N J Time May 28-30, 1930

AMERICAN OTOLOGICAL SOCIETY

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President-Elect Dr J F Barnhill, Miami Beach, Fla
Executive Secretary Dr William P Wherry, Medical Arts Bldg, Omaha
Place Chicago Time October, 1930

SECTIONAL

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Chairman Dr Frederick J Wort, 1080 Broad St, Newark
Secretary Dr Earl LeRoy Wood, 31 Lincoln Park, Newark
Place 91 Lincoln Park South Time 8 45 p m, second Monday of each month

EASTERN NEW YORK EYE, EAR, NOSE AND THROAT ASSOCIATION

President Dr John P O'Keefe, 251 State St, Albany
Secretary-Treasurer Dr Arthur F Holding, 142 Washington Ave, Albany
Time Third Wednesday of October, November, March, April, May and June

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date

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President Dr Harris P Mosher, 828 Beacon St, Boston
 Secretary-Treasurer Dr Charles T Porter, 520 Commonwealth Ave, Boston

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 Secretary-Treasurer Dr Francis A Brugman, Medical-Dental Bldg, Seattle
 Time 8 p m, third Tuesday of each month, except July and August

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NOSE AND THROAT

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 Secretary Dr Fletcher D Woodward, Box 162, University, Va
 Place Louisville, Ky Time November, 1930

STATE

COLORADO OTO-LARYNGOLOGICAL SOCIETY

President Dr Frank L Dennis, Ferguson Bldg, Colorado Springs
 Secretary Dr Rex L Murphy, Metropolitan Bldg, Denver
 Place Assembly Room of Metropolitan Bldg, Time First Saturday of each month from October to May

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

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 Secretary-Treasurer Dr William O Martin, Jr, 384 Peachtree St, Atlanta

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

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 Secretary Dr J G Parsons, Lewistown
 Time Semi-annually

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 Secretary-Treasurer Dr F L Wicks, Valley City

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 Secretary Dr Andrew J Browning, 418 Mayer Bldg, Portland, Ore
 Place Good Samaritan Hospital Time Third Tuesday of each month

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President Dr J E Raia, 272 Broadway, Providence
 Secretary Dr F W Dimmitt, Jr, 195 Thayer St, Providence
 Place Rhode Island Medical Library Time 8 30 p m, second Thursday in
 October, December, February and April

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LOCAL

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 AND LARYNGOLOGY

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President Dr Samuel Salinger, 25 E Washington St, Chicago
 Secretary-Treasurer Dr Austin A Hayden, 25 E Washington St, Chicago
 Place Medical and Dental Arts Bldg, 185 N Wabash Ave Time 6 p m,
 first Monday of each month from October to May

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 Place University Club Time 6 45 p m, second Tuesday of each month from
 October to May

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 AND OTOLARYNGOLOGY

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 Place Winton Hotel Time Fourth Friday of each month

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 Place College of Physicians Time 8 30 p m, third Wednesday of each
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 Executive Secretary Dr W Mood Knowles, Medical Arts Bldg, Dallas, Texas
 Recording Secretary Dr L A Nelson, 4105 Live Oak, Dallas, Texas
 Place Dallas Athletic Club Time 6 p m, first Tuesday of each month from
 October to June The November, January and March meetings are devoted to
 clinical work

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 Secretary Dr Edward W Griffey, Houston Clinic, Houston, Texas
 Place Medical Arts Bldg, Harris County Medical Society Rooms Time
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 Secretary Dr Kenneth L Craft, Hume-Mansur Bldg, Indianapolis
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 October to May

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 Secretary Dr A E Eubank, Argyle Bldg, Kansas City, Mo
 Time Third Thursday of each month from September to May The November,
 January and March meetings are devoted to clinical work

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 Place Pacific Coast Club Time Last Wednesday of each month from September
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 Place California Hospital, assembly room Time 8 p m, first Monday of
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MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

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 Place Eye Clinic of Memphis Eye, Ear, Nose and Throat Hospital Time
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 Place 103d St and 5th Ave Time Second Friday of each month from October
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 Place Medical Arts Tea Room Time 5 15 and 7 p m, third Wednesday of
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 Place Rochester Medical Association, 13 Prince St Time 8 p m, third
 Monday of each month from October to May

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DISEASES OF THE ESOPHAGUS

ANGIONEUROTIC EDEMA URTICARIA SERUM DISEASE AND HERPES *

CHEVALIER JACKSON M.D.

PHILADELPHIA

When one speaks of urticaria angioneurotic edema and herpes all physicians at once recognize clinical entities and know whereof one speaks. When however one attempts to define these diseases to classify and to analyze them and especially to state the etiology and the pathologic mechanism by which the well known lesions are produced one enters the field of the indefinite if not the unknown. Whether any or all of the four diseases included in the title are to be classified as a neurosis or a neuronosis it is neither my intention nor my province to discuss beyond recalling the fact that herpes zoster has been definitely classed as a neuronosis. No one is qualified to predict that herpes simplex urticaria and angioneurotic edema will or will not follow zoster into the same classification. Therefore until the various problems are solved one must continue to record clinical facts leaving to the future the difficult task of creating or adjusting theories and laboratory data to fit these facts. The names and the classification of the diseases may be rearranged in the light of future knowledge but carefully made clinical observations recorded accurately and separated from inferences will always remain clinical facts. It is with the just mentioned thoughts in mind that the following cases are reported.

REPORT OF CASES

ANGIONEUROTIC EDEMA OF THE ESOPHAGUS

CASE 1—A woman aged 38, was sent to the bronchoscopic clinic by Dr. Jacob Wolf because of difficulty and pain in swallowing and retrosternal pain extending through to the back. These symptoms had come on suddenly on the day before admission. Four days before admission the patient had been seized with violent abdominal pain tenesmus white painless swelling of the right hand and swelling of the upper lip the lower lid of the right eye and the tip of the tongue. These symptoms were slightly less but none had disappeared when the patient was admitted. The swelling of the eyelid afterward increased and a bleb formed on it and broke. Within a few hours the patient became unable to swallow solids. Liquids were swallowed slowly and the process was accompanied by a sense of constriction a 'boring sensation' and pain. The previous medical history did not include any esophageal symptoms but there had been a swelling of the palate and

* Submitted for publication April 1929

tongue a number of times, and there was a history of numerous painful gastrointestinal attacks. During one of these attacks, an exploratory laparotomy had given negative results. During two attacks, there had been painful micturition.

Examination—Roentgen examination by Dr. George C. Johnston showed the thoracic esophagus to be closed to a small lumen, through which the opaque mixture trickled slowly. The border of the shadow at the constriction was smooth.

Esophagoscopy showed the mucosa of the hypopharynx to be normal. In the midthoracic portion the lumen was almost completely occluded by firm, swollen, bleeding nodules springing from the right wall of the esophagus. The central portion of each nodule was white, but at the base of each nodule there was a zone of intense hyperemia. The blood seemed to be coming from the narrow creases between the nodules.

Progress—Plenty of water and liquid foods were given, including strained vegetable soups and fruit juices. The ability to swallow gradually improved, until at the end of two weeks it seemed to be normal and free from discomfort. By this time all of the other symptoms had subsided.

A second roentgen examination was made by Dr. George C. Johnston, and the results were negative. The esophagus seemed to be perfectly normal as to lumen and function.

At a second esophagoscopy, the lumen and mucosa seemed perfectly normal. The esophagoscope passed on into the stomach without encountering any obstruction.

Comment—The esophagoscopic appearances of the lesion were unlike those of any of the lesions commonly encountered. Considering their transient character and the accompanying lesions of angioneurotic edema, the diagnosis of angioneurotic edema of the esophagus seems fully justified.

URTICARIA OF THE ESOPHAGUS

CASE 2—A woman, aged 43, was sent to the bronchoscopic clinic by Dr. William B. Ewing because of inability to swallow anything, even water. Saliva was regurgitated at intervals. Difficulty in getting down solids had appeared suddenly at the same time as an eruption of intensely itchy white wheals, covering both sides of the front of the chest, the back and the left side of the face. The facial eruption extended over the left side of the upper and the lower lip and the inside of the left cheek, the mucosa of which was indurated and white. The region of the left parotid gland was swollen and tender. Dr. Ewing declared the dermal eruption to be a typical urticaria. He had treated the patient for previous attacks, none of which had involved the mucosa. A number of asthmatic attacks had seemed to alternate with the urticarial eruptions. Welts and wheals could be produced by scratching the back.

Examination—The family history and the results of general physical examinations were negative. Sensitization tests had not been made, the Bordet-Wassermann reaction was negative.

Roentgen examination by Dr. George C. Johnston showed complete stoppage of the esophagus about 6 cm. above the diaphragm.

Esophagoscopy, without general or local anesthesia, revealed a normal lumen and mucosa down to about the junction of the middle with the lower third. At this point the esophagus was completely closed by a firm, white, nodular swelling of the walls. Reexamination with an esophagoscope of small lumen (5 mm.) revealed no safely permeable lumen. At this reexamination, which was made

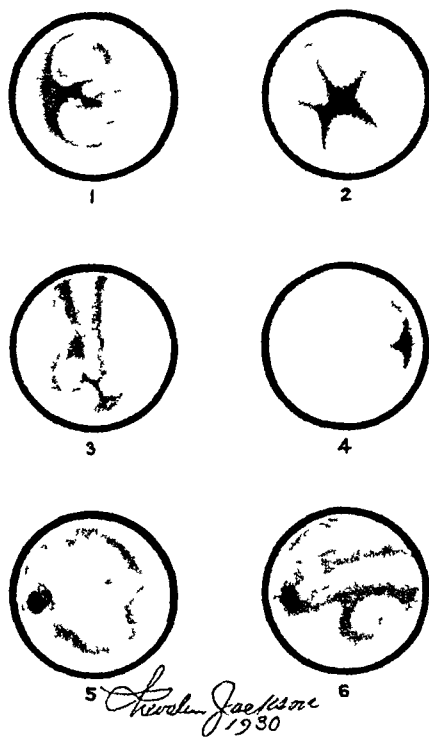


Fig 1 (case 1) —Angioneurotic nodules occluding the lumen of the midthoracic esophagus of a woman, aged 38 years. A little blood lay in the creases between the folds.

Fig 2—The same patient as in figure 1, two weeks later. The hard nodules have disappeared, the lumen has reappeared and the soft, velvety folds are normal. The transient character of the lesion illustrated in figure 1 confirmed the diagnosis.

Fig 3 (case 2) —Urticaria of the esophagus in a woman, aged 43 years. The lumen is closed by white, nodular swelling of the walls. The longitudinal streak appeared after insertion and withdrawal of the esophagoscope, it evidently resembled the urticarial dermal ridges that could be produced at will by drawing the finger across the skin. Esophagoscopy examination of this patient one week later showed the esophagus to be normal at this point as well as throughout its entire extent.

Fig 4 (case 3) —The lumen of the thoracic esophagus at this point, about the level of the crossing of the left bronchus, was completely occluded with firm, nodular swellings that seemed integral with the esophageal wall. There was no bleeding, erosion or ulceration. About ten days later, reexamination showed the esophagus to be normal; the esophagoscope went through into the stomach without meeting any obstruction.

Fig 5 (case 4) —Superficial ulcer of the lower end of the esophagus in a patient with chronic esophagitis. The ulcer was probably secondary to ruptured herpetic vesicles.

Fig 6—The same patient as the one in figure 5. Two vesicles filled with yellowish fluid are seen, one on each side of a long, weltlike ridge. At a subsequent esophagoscopy, the vesicles were seen to have ruptured; their sites were occupied by a flat, grayish exudate. The streak had flattened and was bleeding slightly. At an esophagoscopy a few weeks later the esophagus was found to be normal.

only a few minutes after the first examination, there was noted an intensely red-dened mucosa with a white ridge extending down the anterior wall for a distance of about 7 cm, and ending in the white nodular masses

Progress—The patient was given large quantities of water by bowel. A continuous small flow was substituted after free evacuation of the colon was obtained. No attempts at alimentation or internal medication were made. On the fourth day the rash had almost disappeared. The patient reported that she could swallow water without difficulty.

Reexamination with the esophagoscope about a week after the first esophagoscopy showed the esophagus to be normal as to both lumen and mucosa.

A second roentgen examination with an opaque mixture by Dr. George C. Johnston revealed no abnormality in the esophagus.

Comment—The appearance of the esophageal lesion, the local reaction to the passage of the esophagoscope, the complete disappearance of the esophageal lesion and the coincident dermal and buccal urticaria, all seem to justify a diagnosis of urticaria of the esophagus. The chief distinction between the manifestations in this case and the lesions of angioneurotic edema lies in the production of lesions on the skin by scratching and in the esophagus by passage of the tube. The skin eruption was not of the so-called "giant" form.

SERUM DISEASE OF THE ESOPHAGUS

CASE 3—A boy, aged 18, was referred to the bronchoscopic clinic by Dr. A. B. Booth because of complete obstruction of the esophagus following four days after the injection of a prophylactic dose of diphtheritic antitoxin. The boy had a typical urticaria over the front of the chest and both sides of the face. The tongue was enormously swollen, saliva was drooling from the mouth. There was no difficulty in breathing. Glands in the neck and axilla were swollen and tender. There was slight fever (from 99 to 101 F), and moderate aching pains were present in the muscles and joints of the legs and arms.

Examination—Results of general physical examination by Dr. Booth were negative.

Roentgen examination by Dr. Russel H. Boggs showed complete closure of the esophagus at the level of the top of the aortic arch. The aorta, however, apparently was normal.

Examination of the larynx with the mirror was interfered with by the enormously swollen tongue. The esophagoscope, however, readily exposed the larynx, which was seen to be normal. The hypopharynx was normal. A few centimeters below the beginning of the thoracic esophagus the lumen was completely closed by extremely firm, white, nodular masses that seemed integral with the esophageal wall. There was no bleeding, erosion or ulceration.

Progress—An abundance of water was given by bowel without attempt at alimentation. At the end of five days all symptoms were gone, except that the lymph nodes were still palpable. The ability to swallow returned.

A second esophagoscopy ten days after the first revealed a normal esophagus, the esophagoscope passed on through into the stomach without encountering any obstruction.

Comment—The lesion in the esophagus in view of its appearance, its transitory character and its association with the dermal manifestations, was unusual. Its association with the symptoms of serum disease is noteworthy.

HERPES OF THE ESOPHAGUS

CASE 4—A woman, aged 52, complained of an almost constant feeling of pressure, discomfort and burning referred to the midthoracic region. At times there was pain also, and it extended through to the back. Difficulty in swallowing solids and sometimes liquids, especially hot liquids, had been intermittent, but the attacks were of gradually increased severity since the first one three and a half years before. At that time the patient was under mental stress because of her husband's illness. Since that time she had been free from symptoms between attacks but the intervals were getting shorter. A number of times the diagnosis of "cardiospasm" had been made, and dilatations had been given without benefit. At times the dilatations were extremely painful.

Examination—Roentgen examination by Dr Willis F. Manges revealed a normal outline of the esophagus when filled with barium mixture. It was noted that there was roentgen evidence of well advanced spondylitis of the dorsal spine.

Esophagoscopy showed a chronic esophagitis, especially at the lower third of the thoracic portion, the walls were coated with thick tenacious secretion. In the midst of this chronic inflammatory area there was a superficial ulcer about 12 mm in diameter, covered with a slightly yellowish exudate. Surrounding the ulcer was a bright red zone, showing no infiltration. The hiatal pinchcock was abnormally patulous. A tentative diagnosis of peptic ulcer was made. A 5 per cent solution of silver nitrate was applied to the ulcer through the esophagoscope.

Progress—General medical management under the care of Dr Henry K. Mohler greatly improved the patient's general condition. Bismuth subnitrate was given, dry on the tongue, for its local effect. Two subsequent esophagoscopies showed the ulcer to be healing rapidly, at the end of two weeks, it was completely healed. The subjective symptoms referable to the esophagus totally disappeared. The patient could eat freely of all foods in a normal and satisfactory way. At a third esophagoscopy the esophagus was found to be normal except for a chronic esophagitis of mild degree in the lower third.

About a week later the patient complained of a burning sensation back of the midsternal region on swallowing. The food seemed to pass a sensitive spot, and the burning lasted for an hour or two. Occasional pains were felt in the same region, and at times they extended through to the back. Frequent and painful micturition was complained of.

A fourth esophagoscopy revealed a ridgelike elevation of inflammatory mucosa in the lower third of the thoracic esophagus, the base of the ridge on each side was red, the summit of the ridge throughout its length of about 6 cm was occupied by a grayish-white adherent exudate. The weltlike ridge was not on the site of the former ulcer. Two blebs were seen, one on the anterior and one on the right wall.

A fifth esophagoscopy showed the site of the weltlike ridge to be a flat eroded and bleeding streak. The sites of the blisters were flat and covered with gray exudate.

At the twelfth esophagoscopy, the esophagus was found to be normal.

After the patient returned home her physician reported that she had remained well for about a month. She was then taken suddenly with difficulty in swallowing.

and a feeling of fulness back of the manubrium. This was followed by severe pain in the right leg, which a few days later was covered with a herpetic eruption.

Comment—The eroded, weltlike ridge in the esophagus, appearing suddenly in an esophagus known to have been free from it a few days before, and its disappearance a week later, implies an evanescent lesion. The ulcer that was present when the patient was first examined healed under treatment. It was probably a chronic lesion following an acute lesion. The acute primary lesion was probably herpetic. No lesion other than herpes or angioneurotic edema would be so evanescent as the esophagoscopically observed acute lesions were seen to be. The herpes zoster and the esophageal lesions may both have been related to the spondylitis, though this seems unlikely.

CONCLUSIONS

1 Angioneurotic edema, urticaria, serum disease and herpes may involve the esophageal mucosa.

2 Herpes is distinguished by blisters or blebs that soon break, leaving a raw, eroded surface, which is later covered with exudate.

3 Angioneurotic edema, urticaria and serum disease of the esophagus are associated with other similar manifestations.

4 Their affinities may preclude differential diagnosis as among them and they may be essentially the same, however, there is no difficulty in distinguishing them from other lesions of the esophagus, provided the esophagoscope is used.

5 The esophagoscope is the only means by which the diagnosis can be made with certainty.

6 The day has arrived when it may be said that it is unjustifiable to treat a patient for conditions in the esophagus without looking into the esophagus.

DISCUSSION

DR HARRIS P. MOSHER, Boston. I have always felt that one would find some anaphylactic phenomena back of the series of cases which Dr. Jackson presented. I am much surprised that anaphylactic tests were not made in these cases.

I would like to ask about the x-ray picture in the last case of ulcer of the esophagus. Does that show the type of cardiospasm that one would find in peptic ulcer?

DR HENRY H. FORBES, New York. About six or seven years ago I had an experience which I think will be of interest. It was a most remarkable case of chronic pemphigus which lasted some years. The patient, a man, came to the Post Graduate Hospital with a history typical of that in Dr. Jackson's first case. He had been unable to swallow for thirty-six hours. The x-ray picture showed the same obstruction, and on examination of the esophagus the instrument could be passed down only a certain distance. Knowing the possible anaphylactic conditions existing, as Dr. Mosher said, one of the house physicians suggested the use of epinephrine. The patient was given 12 minims of the epinephrine hydrochloride, and within about fifteen minutes he could swallow as well as any one and

although a second esophageal examination had not been made, a second x-ray picture showed that the column of bismuth went down in a perfect line

SIR ST CLAIR THOMSON Some of these vague manifestations have been known to me for many years, and in England the title of "Quincke's edema" is used I would suggest that it is rather useful to use a comprehensive term like that for these various manifestations until one is able to differentiate them from one another Just as the term "septic sore throat" is used to cover acute edema of the larynx and pharynx and a number of the diseases which have similar symptoms, so here the term "Quincke's edema" is still used I have seen these transitory edemas not only on the face and the eyelids, on the lips and inside of the cheek and the tongue, but also in the larynx I have seen them appear and disappear, and I have never seen serious results I generally treat them with arsenic and patience

The question of the relationship of herpes to pemphigus is interesting I have watched a few cases of herpes located chiefly in the fauces and in the larynx In all the cases of pemphigus that I have seen (only about three or four) the patients have died, the condition has not appeared and disappeared although the lesions have improved In pemphigus of the larynx the symptoms never disappear entirely, and it has taken sometimes two, and never longer than three years, to prove fatal Perhaps my experience is limited, but still I fancy that in England there are perhaps as many patients with that type of disease as there are in this country Perhaps I am rather an unsympathetic person, but I believe that these cases may be classified as the neurotic, the erotic and the tommyrotic

DR SIDNEY YANKAUER The only cases of this kind that I can recall seeing, I saw during the stage when the esophagus was normal

DR CHEVALIER JACKSON Replying to Dr Mosher, four different roentgenologists in four different cities had made a diagnosis of cardiospasm Dr Manges recognized the presence of an anatomic narrowing which did not, for the time being, disappear and did not shift its location After the lesions had healed, the esophageal wall was apparently in its normal place, and the lumen was normal I omitted a number of details in regard to the last patient She had herpes in a number of places on the body, of apparently the type of herpes febrilis Under treatment by Dr Mohler, which included rest in bed and cutting down the cigarets from about 150 a day to five or six, and the elimination of various other things that a neurotic person should not indulge in, she was apparently brought back to normal She was sent home and her physician reported that she was well for a few weeks, then she developed a herpes zoster of the leg, which has had a prolonged and extremely painful course, followed by postherpetic pains such as those patients often have In the pre-esophagoscopy days this condition would have been called cardiospasm I think the suggestion of Sir St Clair Thomson that these diseases all be classed together, until more is known about them, is excellent That is why I have grouped them in this paper

EYE, EAR, NOSE AND THROAT COMPLICATIONS OCCURRING IN PATIENTS IN A HOSPITAL FOR THE TUBERCULOUS*

GEORGE H B TERRY, M D
OTEEN, N C

The Veterans' Hospital at Oteen, six miles from Asheville, N C, during the last three years has had an average patient population of about 700. About 99 per cent of the patients are tuberculous, a large percentage of whom are confined to their beds. At the time this paper was written, a census showed the hospital to have 563 patients: twenty-two have temperatures above 100 F, ten are classified as critically ill, and eighteen are listed as seriously ill, but as a matter of fact any patient with pulmonary tuberculosis has a serious illness. Of the 563 patients, all but 96 receive their food on trays, and 200 of them have to be bathed in bed.

In addition to these, a varying number of outpatients come to the hospital, many of whom are nontuberculous, but it is a conservative estimate to say that 95 per cent of the work is for the tuberculous patient. In these patients, diseases of the eye, ear, nose and throat are rarely considered a major disability. The treatment, then, must be modified and often omitted. However badly one's dwelling may need repairs, one does not undertake them if the house is on fire. Many of the patients arrive on litters in the last stages of pulmonary tuberculosis with only a few weeks, or sometimes a few days, to live. In the absence of symptoms, any routine examination of the eye, ear, nose and throat is contraindicated. Of what use is it to determine the patient's color perception or his visual acuity, or to record the fact that he has a deviated septum and chronic tonsillitis? The first duty is to care for a human being—not to conduct research work. It might be said that all these patients should at least be examined for laryngeal tuberculosis. In this I do not agree. When these patients have symptoms of diseases of the throat it will be time enough for intervention. I am speaking now, of course, of the patients with far advanced, hopeless cases, on whom the useless burden of needless examination should not be laid.

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* From the United States Veterans' Hospital, Oteen, N C

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While I have stated some of the difficulties encountered in dealing with tuberculous patients, let it not be understood that but little can be done for these unfortunates. Especially in cases in which the larynx is involved, the method of treatment often means either life or death. For many other patients who sooner or later must succumb much can be done to relieve suffering and to add to the patient's comfort and morale.

RETINAL HEMORRHAGE AND IRITIS

An unusual tendency to retinal hemorrhages has been noted among these patients. Under appropriate treatment, the vision usually returns to normal in a short time, but recurrences are frequent.

On March 26, 1926, I was called to see a patient who was confined to his bed and who stated that the night before he had suddenly lost nearly all vision in the right eye. He could count fingers only. The fundus could not be seen. He was given atropine and was told to rest. By April 9, vision had increased to 5/200, and on April 16, it was 20/200. On April 23, ethylmorphine hydrochloride, U. S. P., was substituted for the atropine and by May 21 vision had increased 20/40. On September 2, there was recurrence of the hemorrhage. He improved somewhat, but on September 13, there was another hemorrhage and another on November 15. In December, he had several slight hemorrhages. On April 29, 1927, vision was back to 20/30, and reexamination one month later gave the same results. The patient stated that the vision in this eye was 20/30 at the time he entered the army. He was discharged from the hospital soon after the last examination and has disappeared from observation.

Another condition of the eye that has been noted frequently is the tendency to recurrent attacks of iritis. These are usually mild, and the patients readily recover after a few instillations of atropine. In a few months, there is usually a recurrence. A case has never been seen which was considered a true tuberculous iritis.

TUBERCULOSIS OF THE EYE

There have been three patients in whom a diagnosis of tuberculosis of the eye has been made.

CASE 1.—A negro, aged 30, on admission to the hospital showed vision in the right eye reduced to form perception only. He stated that it had been getting worse for seven years. Tension was reduced, the eye was tender, and a large leukoma made examination of the deeper structures impossible. Some one had made a diagnosis of syphilis of the eye, and for this reason he was unable to secure compensation. No other evidence of syphilis could be found. The Wassermann reaction was persistently negative. Enucleation was advised for two reasons: first, the eye was useless, disfiguring and at times painful, second, it was necessary to clear up the diagnosis. Laboratory examination showed no evidence of syphilis in the enucleated eye, but showed the picture to be that of tuberculosis. An examination of an enlarged gland in the neck which was removed showed tuberculosis. The patient made a good recovery, is wearing a well fitted prosthesis, was able to secure compensation and is having no further trouble.

CASE 2—The patient said that vision had been poor in the left eye for some time. Examination showed a moderate amount of astigmatism in each eye. Vision with correction in the right eye was 20/20 and in the left eye, 20/200. Examination of the fundus showed a diffuse retinitis in the macular region. The patient has been under observation for about three years, and no special changes can be detected in the fundus. The eye, however, is frequently painful unless excluded from the light, and the vision has now dropped to 12/200. This patient has been seriously ill all this time from pulmonary tuberculosis.

CASE 3—A man, aged 28, complained of constantly recurring headache. He had pulmonary tuberculosis and a negative Wassermann reaction. Under treatment with homatropine, he wore glasses with a plus 1.25 sphere which corrected the vision to 20/20 plus 1. The right eye showed a small area of choroiditis 1 disk diameter below the disk. Four months later, two similar lesions appeared in the left eye a short distance below the macula. The patient's tonsils had been enucleated, the sinuses appeared normal, and the dental service found no suspicious teeth. The diagnosis of tuberculous choroiditis was thus made by exclusion. The patient has been examined from time to time during the last two years, and there seems to be no further extension. He comes back to the clinic every month or so complaining of severe headaches, which are relieved at once by a drop of atropine or homatropine.

TUBERCULOSIS OF THE NOSE

No cases of tuberculosis of the nose have been seen. When symptoms have been urgent, a few deviated septums have been operated on with satisfactory results.¹

No sinuses except the maxillary have been operated on, and in these the simplest operation possible has been done—a resection of the naso-antral wall with subsequent irrigations. In several of these cases, the effect on the patient has been little short of marvelous. I shall cite one case.

A patient suffering from pulmonary tuberculosis, who was confined to his bed, was sent to the Eye, Ear, Nose and Throat Department on Nov. 20, 1926, on account of severe headaches. He had some nasal discharge, and the right antrum was found by transillumination to be dull. This was confirmed by roentgen examination. Puncture and lavage showed foul pus. He was referred to the dentist, and one suspicious tooth was extracted. Puncture and lavage were repeated several times at varying intervals, but the condition failed to clear up, and on Feb. 24, 1927, a partial turbinectomy and resection of the naso-antral wall was done. The patient's headaches disappeared, his fever and toxemia were relieved, and he gained 25 pounds (11.3 Kg). Soon after this he left the hospital without permission and was married. He returned in a few months. He had a slight discharge from the right nostril, but no other symptoms. Examination at this time showed that the pulmonary condition was much improved. In only one patient has the laboratory report showed tubercle bacilli present in the pus obtained from the antrum.

¹ Since this paper was written, one patient showing a tuberculous lesion of the left nostril has been admitted.

NONTUBERCULOUS CONDITIONS OF THE EYE

Several interesting nontuberculous conditions of the eye have been seen

CASE 1—A physician, aged 54, suffering from pulmonary tuberculosis, complained of pain in the eyes, photophobia and what he described as a "flickering" first in one eye and then in the other. These attacks would last two or three days, would be relieved by cold applications, but in a short time would recur. He was unable to read, except for a short time, on account of the asthenopia. His vision, with correction, was 20/20 in each eye, tension was normal. There was no lesion of the fundus, the tonsils and sinuses were normal. He was referred to the dental clinic for removal of any foci of infection that might be found, and following the extraction of several teeth the symptoms promptly disappeared.

CASE 2—A dentist, aged 47, with no tuberculous history, came to the hospital on Dec 22, 1927, complaining of some blurring of vision in the right eye. He gave a history of having just recovered from an illness of several weeks' duration, which was supposed to have been due to influenza. His vision was 20/50 in the right eye and 20/30 in the left. In the right eye the field was much contracted, in fact, it was almost a gun barrel type of field. The disk was much blurred. There were patches of exudate and a few small hemorrhages in the retina. The tonsils had been enucleated, the sinuses were clear, and there was no evidence of nephritis. Removal of infected dental foci was suggested. All the teeth were extracted, and the condition promptly improved. By Feb 3, 1928, vision was 20/20 in each eye, there was no contraction of the visual field, and the patient said that he felt better than he had at any time for over a year.

CASE 3—A woman, aged 32, married, with no tuberculous history, complained of poor vision suddenly occurring in the right eye. Vision was found to be 20/200 in the right eye and 20/20 in the left. The media were not clear, but an area of chorioretinitis could be made out near the macular region. The patient had chronic tonsillitis. The sinuses were normal. The tonsils, although slightly enlarged, did not give the appearance of being a probable factor in the condition of the eye. She was therefore referred to the dental clinic for removal of dental foci. Following the extraction of abscessed teeth, she promptly improved and was discharged in six weeks with normal vision. In addition to the removal of the offending teeth, these two patients were both treated with ethylmorphine hydrochloride in increasing strengths, and rest in bed was insisted on.

An examination of the eye is frequently called for, and rightly so, when tuberculous meningitis is suspected. In this hospital tubercles have occasionally been found in the choroid but never early enough to make them an important factor in the diagnosis. The most constant observation in the fundus is hyperemia of the disk. It is believed, however, that inequality of the pupils, photophobia and diplopia, especially if at first they are of short duration, are much more important symptoms and are more valuable than any shown by an examination of the fundus, because they occur early. The transitory nature of any one of these, if not explained by other causes taken in conjunction with persistent headache in a tuberculous patient makes the diagnosis of tuberculous meningitis probable.

LESIONS ON THE TONGUE

In this hospital it is the custom to refer patients showing lesion on the tongue to the eye, ear, nose and throat department. During the last three years, there have been ten cases showing tuberculous ulceration.

CASE 1—An ulcer of considerable size on the tongue, as well as ulceration in the lower jaw, was present in a patient referred to this department with a request for a biopsy on the tongue. The patient was advised against this procedure, but it was done by another surgeon and the lesion proved tuberculous. Following the biopsy the lesion rapidly spread, and the patient died in six weeks of pulmonary tuberculosis.

CASE 2—This patient had an ulcer on the tongue of three years' duration. Following four cauterizations at intervals of from two to six weeks, he was transferred to another hospital with the lesion on the tongue much improved.

CASE 3—This patient showed an ulcer about the center of the tongue of five weeks' duration. It was cauterized four times and was considerably improved at the time of the patient's death from the pulmonary lesion four months later. Postmortem section showed the lesion to be tuberculous.

CASE 4—A tuberculous ulceration was present far back on the left side of the tongue. It was cauterized on July 13, 1926, and the patient was discharged from the hospital five months later with the ulcer completely healed.

CASE 5—A man had a large painful ulcer on the under side of the tongue near the tip. The symptoms were entirely relieved after a few cauterizations, and he died ten months later of pulmonary tuberculosis, without recurrence of the ulceration.

CASE 6—An ulcer of three weeks' duration was present far back on the right side of the tongue. This was cauterized and gave no trouble for one month, when some tenderness was again noted. It was not necessary, however, to recauterize. This lesion remained healed, but a year and a half later the man developed another ulcer about the center of the tongue, which yielded to two cauterizations.

CASE 7—A patient was transferred from another hospital with an ulceration on the tongue of one year's duration. He had been treated for six months with a quartz lamp without benefit. One cauterization was done, and the ulcer was entirely healed and remained healed up to the time of his death from pulmonary tuberculosis a few months later.

CASE 8—Two small lesions were present on the upper surface of the anterior portion of the tongue. These were painful and had existed for several months. One cauterization was done. The patient was discharged from the hospital ten days later with the ulcerations entirely healed.

CASE 9—A patient had ulceration on the right side of the tongue of three months' duration. One cauterization resulted in complete healing. Examination one year later showed no recurrence.

CASE 10—A patient had a large ulcer on the right side of the tongue. Cauterization was done. This was repeated in two months. Two months later, the patient left the hospital against medical advice with the ulceration entirely healed.

Comment—All of these patients, except the one in case 5, had negative Wassermann reactions. Practically all of them had been treated with nitrate of silver or other medicaments before they were sent to the clinic for cauterization.

Of the nine patients cauterized, complete healing was secured in six, two left the hospital much improved, and one died of the pulmonary lesion before the tongue had entirely healed.

I know of no tuberculous lesion that responds to treatment so well as these ulcerations of the tongue.

My associates and I do not hesitate to perform tonsillectomies on tuberculous patients, but the indications must be definite and clear. A careful laryngeal examination should always precede the operation. We always operate under local anesthesia and frequently remove only one tonsil at a sitting and thus lessen the chance of an unfavorable reaction. From time to time reports appear of patients dying from the local anesthetic used for tonsillectomy. For this reason we never make injections into the second tonsil until the first has been removed and with it, of course, the major portion of the anesthetic used. In this way, we believe we avoid practically all danger from the anesthesia. Only one of the tonsils that we have removed was found to be tuberculous.²

LARYNGEAL TUBERCULOSIS

Laryngeal tuberculosis, as is well known, is a frequent complication of pulmonary tuberculosis. One of the earliest signs is hyperemia of the vocal cords. When this occurs it is necessary to differentiate between tuberculosis, syphilis and irritation from excessive coughing or chronic tonsillitis as a causative factor. The patient should at once be instructed to rest his voice. He should be reexamined from time to time, when the subsequent changes will usually make the diagnosis clear. In the presence of pulmonary tuberculosis and a positive Wassermann reaction the diagnosis, however, may long remain in doubt, unless the patient can be put on active antisyphilitic treatment as a therapeutic test. The usual pathologic changes in laryngeal tuberculosis are general infiltration of the larynx, edema of the arytenoids, proliferations in the posterior commissure or a thickening of the epiglottis or even ulceration. The most frequent site of ulceration is the vocal cords or the epiglottis, although not infrequently it is in the vocal bands or arytenoids. When

² Since this paper was written, more tonsillectomies have been done in the hospital in far advanced cases and more tonsils with tuberculous lesions have been found. At this writing, 12.5 per cent of the tuberculous patients operated on have shown tuberculosis of the tonsil on laboratory examination. Healing has occurred in these and if the condition had been known prior to operation it would not have been a contraindication to enucleation.

the diagnosis is made, the treatment should be begun. The two lines of treatment that have been found most efficient are voice rest and electric cauterization, and there are many cases in which it is the part of wisdom to begin the voice rest long before the diagnosis is definitely established. Any patient with pulmonary tuberculosis who has a tendency to hoarseness should rest his voice. If this were more often done, the incidence of laryngeal involvement would be much decreased. The best kind of voice rest is absolute voice rest, the patient using a pad and pencil instead of the vocal cords. Patients who will not do this are urged to substitute a whisper for ordinary speech. Smoking is usually thought to be harmful, but I believe that most addicts can smoke in moderation without harm to the larynx and with some benefit to their morale.

After being told to rest his voice, the patient should be reexamined each month. He should be examined oftener only if the symptoms demand it. Disturbing the patient for frequent examinations or, what is worse, for various topical applications is as much contraindicated as is the too frequent removal of surgical dressings from a healing wound. Under this treatment a fair number of patients with undoubted laryngeal tuberculosis will recover, especially if the pulmonary condition is improving. The course of the laryngeal disease, however, does not by any means always follow that of the pulmonary condition. One of the most malignant cases of laryngeal tuberculosis that I have ever seen occurred in a patient whose pulmonary lesion was not extensive and was thought to be improving. On the other hand, time after time I have seen the laryngeal lesion heal under appropriate treatment and stay healed, while the pulmonary condition goes from bad to worse.

If the monthly examination shows that the patient is not making satisfactory progress, electric cauterization is done under local anesthesia from moistened cocaine flakes applied two or three times to the area involved and preceded by a spray of 4 per cent cocaine to prevent gagging. The indirect method of illumination is used, the cautery point is placed cold on the ulceration and the current applied until the area is well seared. For the epiglottis and arytenoids a pointed electrode is frequently used, and punctures are made into the swollen area in addition to surface cauterization. After treatment nothing is done, except occasional administration of an analgesic for the pain. This rarely occurs, as in the painful cases the cauterization usually at once relieves the pain. The patient is reexamined in one month, and if necessary the cauterization is repeated. Of the last sixty-eight patients operated on thirty received one cauterization, twenty-three received two cauterizations, six received three cauterizations, three received four cauterizations, three received five cauterizations, one received six cauterizations, one received eleven cauterizations and one received twelve cauterizations.

Some laryngologists believe that cauterization should not be done if the case is hopeless from a pulmonary standpoint. With this belief I am not in accord. In many cases, hopeless from both a laryngeal and a pulmonary standpoint, the operation is indicated for relief from pain. In such a case a recauterization is not usually urged but is done at the patient's request as a palliative measure.

How long should the interval be between cauterizations? A month, as a rule, but to this rule there are some exceptions.

In the two patients referred to as having had eleven and twelve cauterizations, respectively, the condition was hopeless and the cauterizations were repeated at the patient's request as a palliative measure only. In one, several cauterizations were done at weekly intervals, and no untoward effects were observed, but the pain was markedly relieved.

Other methods for the relief of the intolerable pain include the painting of painful granulations with 10 per cent nitrate of silver, orthoform applied locally, use of cocaine spray and sometimes the injection of 20 minims of alcohol into the superior laryngeal nerve. In this hospital, the last measure is usually unsuccessful, but occasionally it has given wonderful results.

There has been one patient in whom a tracheotomy was required for laryngeal obstruction due to tuberculomas of the cords. This was done twenty months ago. The patient is still wearing the tube with comfort, and the pulmonary condition is much improved.

SUMMARY

Experience with the electric cautery has led my associates and me to believe that

1. Electric cauterization will result in healing in nearly all cases of tuberculous ulceration of the tongue if used reasonably early.

2. It is the best method of treatment for the tuberculous larynx that fails to yield to voice rest. With early lesions, complete healing is the rule after a few cauterizations. With most of the advanced cases it is the most efficient method for the relief of the excruciating pain and enables the patient to take much needed food. In many of these cases the condition is not as hopeless as it looks, and healing will often take place following cauterization of extensive lesions.

3. Not the least of the advantages of the cauterization treatment is that it interferes so little with the rest in bed that is so important in the treatment of patients with pulmonary disease.

LESIONS OF THE EAR

Chronic suppurative otitis media is a comparatively frequent complication of pulmonary tuberculosis, but the tubercle bacillus is rarely

found in the discharge. Owing to the patient's debilitated condition treatment is decidedly unsatisfactory, and the ears will frequently discharge intermittently for years. In this hospital, treatment usually consists of cleansing the canal with alcohol, or alcohol and boric acid and in the acute conditions of applying heat by means of a therapeutic lamp.

No mastoids have been operated on in more than three years. A patient was admitted, however, in March, 1927, who gave a history of operation on the left mastoid the previous July. The wound did not heal, and he was again operated on the following December, this wound was still open when he came to this hospital. No treatment was of any permanent benefit, and after about one and one-half years he became discouraged and left against medical advice. This case was proved tuberculous by laboratory examination.

Three patients with acute mastoiditis were sent to the hospital for operation. One was found to have a positive Wassermann reaction, and the condition of the ear cleared up under antisyphilitic treatment. The other two promptly recovered after free incision of the membrana tympana and application of heat from a therapeutic lamp. One of these patients was of especial interest. He was admitted with an acute mastoiditis of two weeks' duration, and among other definite signs there was sagging of the posterior superior wall, which is usually considered a positive indication for operation. There were, however, some indications for avoiding operative procedures. First, there was a definite attack of facial erysipelas as a complication, and second, the patient had far advanced pulmonary tuberculosis with cavitation. Roentgen examination showed definite clouding of the right mastoid and the right antrum. Conservative treatment of the mastoid was decided on, and a free incision was made in the tympanic membrane and frequent applications of heat by means of the therapeutic lamp were given, later, when the patient had recovered from the erysipelas, the antrum was operated on. He promptly recovered from the condition of the ear, with 20/20 hearing.

CONCLUSIONS

My associates and I realize that it will be a long time before the last word is said as to the best method of handling the tuberculous patient, but our experience has led us to believe that

1. Electric cauterization should be more frequently employed in the treatment of tuberculous lesions of the tongue and larynx.

2. Operation on antrum with chronic suppuration will frequently cause a marked improvement in the pulmonary lesion.

3. Operation on the other nasal accessory sinuses can usually be avoided.

4 Too many operations have been done for mastoiditis

5 In obscure conditions of the eyes, a careful dental examination is imperative

ABSTRACT OF DISCUSSION

DR JOSEPH B GREINF, Asheville, N C I wish to make an earnest appeal for a more general use of the electrocautery in the treatment of patients with tuberculosis of the larynx and of the tongue As St Clair Thomson says, it is the most effective treatment both for "ease and for cure" In my experience the cautery is best suited to lesions within the larynx proper, the cords, the vocal bands and behind the commissure Tuberculosis of the pillars of the fauces and the soft palate does not seem to respond so well to the cautery In these cases, the reaction to the infection is already so great that the electrocautery only makes matters worse Fortunately, lesions of the posterior wall of the pharynx also respond well to the action of the electrocautery Every sanatorium should be equipped with the necessary apparatus, with someone in charge who is experienced in its use The indirect application of the cautery possesses a distinct advantage over the direct method This method is certainly more comfortable for the patient and avoids trauma of the epiglottis, an important consideration The indirect method is simple and easy for the operator and comfortable for the patient It has been surprising how few cases of tuberculosis of the middle ear in adults come to operation for a mastoid infection I refer particularly to adults suffering with pulmonary tuberculosis In my experience, only two such patients have come to operation, and one of these might well have been spared the necessity of opening the mastoid Children with tuberculosis of the middle ear, however, have a different type of tuberculosis, usually glandular rather than pulmonary, which seems more frequently to require operation on the mastoid

In reference to the advisability of removing one tonsil at a time in the tuberculous patient, I am rather inclined to remove both tonsils at one operation, provided the patient's general condition warrants operative intervention However, in operating in such cases it is important to avoid trauma as much as possible and spare the patient needless loss of blood It is well known that tuberculous patients do not stand operations well, and we resort to operation only when the indications are urgent It is, of course, understood that in the removal of tonsils in the tuberculous, local anesthesia should be used

DR CHARLES W BROWN, San Diego, Calif Dr Terry's statement, "However badly our dwelling may need repairs, we do not undertake them if the house is on fire," and "no critically ill are given an eye, ear, nose and throat examination unless special complaint is given at time of admittance," I heartily approve, and I think that he has given us an excellent paper

Ulcerations in the nose, whether definitely tuberculous or not, should be treated by actual cautery or one of chemical nature, to me, trichloroacetic acid in its original form has given the best results, and it is applied with ordinary wooden applicators Regarding operation on the sinuses, in my opinion, patients with moderate or light infections of the chest are benefited by removal of infected tissues, such as polyps in the ethmoids and sphenoids, or by a cleaning up of the infection in an antrum by a naso-antral window or even a radical operation, if indicated Conditions of the teeth and gums should be charted and treated as soon as the patient's condition permits Ulcerations of the tongue are usually easily treated if recognized and treated with cautery Tonsillectomy is to be done when needed, as in nontuberculous patients

In every case calling for operation, there should be, prior to the operation, a thorough examination, particularly laryngeal

A man, aged 58, on whom I did a laryngectomy two months ago and who is now entirely recovered from the operation and is working and feeling fine was treated for over one year for syphilis in spite of a negative Wassermann reaction and the absence of other symptoms of the disease and a negative history, and on whom no biopsy was made until prior to the laryngectomy

I am heartily in accord with Dr. Terry regarding absolute voice rest on finding any pathologic condition in the larynx when there is definite tuberculosis of the chest. "Dead men tell no tales" is a proverb well applied to cauterization of the ulcers of the larynx, for then the patient is more able to eat and put on weight and fight against his infection, and none should be considered hopeless because of an ugly looking larynx. At the present time, I have under my observation four cases of definitely healed laryngeal tuberculosis and two of the patients have been ardent users of a direct sunlight and mirror treatment.

Acute infections of the middle ear should be treated as in other patients, but in chronic cases, cleanliness, zinc ionization, cresatin or boric acid in alcohol should be given thorough trial before submitting the patient to operation.

Bronchoscopy is of vital importance in a hospital for tuberculosis.

DR THOMAS E. CARMODY, Denver. We have often found that patients who were told that they could only whisper were suffering more injury than those who talked out loud. Dr. Terry spoke of that. Some patients who are told to whisper do it easily, but some strain too much.

The use of the cautery in laryngeal tuberculosis, gives complete comfort in many cases. On the other hand, I recently had a patient who was much depressed over the fact that we suggested the use of the cautery. He said that he had been hurt so many times by a cautery that it terrified him. His physician had used it, making three or four punctures at one sitting. I think that is a mistake, because sometimes it causes more ulceration and trouble than before. If I understood Dr. Terry correctly, he said that he had found the tubercle bacillus in cases of disease of the maxillary sinus. I wish he would speak of that again. The point of taking out one tonsil at a time has been brought up before by the chairman of this Section. As you know, he recommended taking out one tonsil. I have never performed the operation in this way, but in some cases it would be better to do so because some of these patients, even those apparently in perfect health, lose much blood, and the tuberculous patient must be spared that if possible.

DR THOMAS J. HARRIS, New York. At least two points in this paper should be emphasized. First, the need in all cases of routine examination of the upper respiratory tract, by which I mean the nose, the nasal pharynx and the larynx. The value of such examination cannot be overestimated, and it is too often avoided or omitted. The second point is with reference to the almost constant omission, in sanatoriums, of examination of the larynx. I want to put in an earnest plea that such examination, if the condition of the patient will permit, should be made, and not made by one of the general staff, but by a trained laryngologist. Dr. Terry did not mention the treatment De Reske of New York has been giving by artificial pneumothorax. He reports favorable results in laryngeal tuberculosis. The second point is something I learned last year on a visit to the Finsen Institute in Copenhagen. I learned there, rather to my surprise, that they do not claim that light will cause decided benefit, sufficient to depend on it alone,

therefore, it is their practice to use light not only on the larynx, but also on the body generally, in order to improve the condition of the patient and permit what has been so strongly advocated here, namely, the use of the electrocautery

DR G H B TERRY In regard to the tubercle bacillus in washings from an antrum, it is true that in one case it was found, a case showing no real symptoms of sinusitis. There was no pus and no indication that the patient had sinusitis. This was undoubtedly a sputum contamination. I do not believe we have ever had a patient with tuberculous sinusitis. With reference to the fact that artificial pneumothorax has a good effect on the larynx, I believe that is true. However, we have had two patients in whom artificial pneumothorax was done who developed typical laryngeal tuberculosis. I believe that it does good, but it does not absolutely prevent the development of laryngeal tuberculosis.

SUBMUCOUS RESECTION OF THE NASAL SEPTUM IN CHILDREN *

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Several years ago I undertook the partial submucous or modified submucous resection of the nasal septum in children with a view to relieving or ameliorating the symptoms incident to mechanical defects still present in the nose after the removal of the tonsils and adenoids. Knowing full well the antipathy felt by competent operators toward disturbing the nasal septum in persons under 15 or 16 years of age, I performed the operations conservatively. As no unfavorable results were seen following conservative lines, more and more tissue was removed at later operations until a considerable amount was taken out, and the results in fifty patients were published two years later. The paper was favorably received, and with the encouragement of my confrères and because of the continued improvement seen in the patients, the procedure has been carried out until the number of case records is now more than a hundred. The patients have been kept under observation by having them report at frequent intervals. Considering the roving type of patient one has to deal with in a clinic in a large city, the check-up has been good¹. Concerning the patients not frequently seen, or those who have disappeared from observation, it may be assumed that if there had been decidedly poor results the patients would have let it be known. As so many unsatisfactory results were being obtained in patients suffering from nasal obstruction in whom the tonsils and adenoids had been removed for its relief, it was decided to combine the removal of the tonsils and adenoids and the deflected septum, when present. The reaction was not much greater than that after the removal of the tonsils and adenoids only. Much valuable time was thus saved, as otherwise the patients would undoubtedly be returned to some clinic with the complaint that no improvement was noticeable in the nasal breathing, and pleas to remove the adenoids would again be made. It was a noticeable fact that, barring actually inferior operations on the tonsils and adenoids, recurrent or secondary tonsils and adenoids were practically always associated with the presence of an obstructing nasal septum. In fact, with a history of one or more removals of the

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¹ Practically all of the clinical patients were at the Manhattan Eye, Ear and Throat Hospital, Dr McCullagh's Clinic

tonsils and adenoids and a further demand for their removal, it became the custom to examine the nasal septum first and then proceed with examination of the throat. This recurrence of secondary growths occurred in one sixth of the patients in the first series and was about the same in the second.

Relationship Between Septum, Palatal Arch, Head Indexes and Nationality

Sex about equal		Heads *	
		Number	Per Cent
Brachycephalic		104	55
Mesaticephalic		52	26
Dolichocephalic		34	18

	Arch		Brachycephalle		Mesaticephalle		Dolichocephalle	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Normal	76	37	41	21	17	9	12	6
Slight	3	1	3	1				
Moderate	60	32	34	18	19	10	7	3
High	43	21	19	10	14	7	10	5
Very high	5	?			2	1	3	1
Flat	9	5	7	3			2	1

	Septum		Brachycephalle		Mesaticephalle		Dolichocephalle	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
Normal	66	34	42	22	13	6	11	5
Slight deviation	7	3	2	1	1	1	4	2
Irregular	18	9	6	3	7	3	5	2
Deviation typical	37	19	21	10	11	5	5	2
Marked	2	1					2	1
Thick	11	5	8	4	3	1		
Spurs	47	24	24	12	16	8	7	3
Dislocation	1	1			1	1		
Deviation with spurs	1	1	1	1				

Nativity								
Children				Parents				
	Num ber	Per Cent		Num ber	Per Cent		Num ber	Per Cent
American	179	94	American	25	13	Spanish	1	1
Jewish	6	3	Jewish	80	44	Slav	6	3
Italian	3	2	Italian	32	17	American French	2	1
Slav	1	1	Irish	4	2	American Italian	2	1
Spanish	1	1	Teutonic	6	3	Irish American	1	1
			British West Indian	1	1	Teutonic Irish	2	1
			American Scotch	1	1	American Slav	13	7
			English American	1	1	Italian Slav	1	1
			Teutonic Slav	1	1	Slav American	1	1
			American Teutonic	8	4	English	1	1
			Swedish	1	1			

* Percentage only approximate

Because the deflected septum occurred so frequently in children and in so many types of children, an investigation concerning the relationship between the septum, palatal arch, the head indexes and nationality was undertaken. Approximately 200 consecutive patients (children) about to be operated on for tonsils and adenoids or septal deflections were examined relative to these factors. The results are shown in the accompanying table.

From the table it would seem that in this particular series children having brachycephalic (short) heads constituted more than one half of those examined. Among these, 21 per cent had normal arches as compared to the total of 37 per cent for all types of heads. A normal septum was present in 22 per cent as compared to 34 per cent of the total for all patients, in other words about one third of the children presented normal palatal arches and normal septums for all head types. Regarding parental nativity only 13 per cent were American born. Of the foreign born 44 per cent were Jewish and the rest were divided between the British Isles and European continental countries. Of the children 94 per cent were American born, the balance having the nativity of the parents.

CHANGES IN THE SKULL FROM BIRTH TO PUBERTY

It might be well at this point to ponder over or consider the anatomic physiologic and mechanical changes going on in the infant skull from birth to puberty. In no one region of the human body are so many and diverse actions taking place. Except for the fact that sufficient nutriment has been stored in the fetus no form of nourishment is taken for a number of hours after birth. However definite structures have already been formed. With the exception of the teeth the organs for the assimilation of food are practically complete. The special senses—seeing hearing etc—require education or practice only. The nose and accessory sinuses are essentially in the formative state. True, there is a septum nasi and beginning sinuses and antrums, which, however, must share the masses of the maxillary bones with the buds of two sets of teeth. There may be a semblance of ethmoid cells, but the frontal and sphenoid sinuses are not yet in evidence. These are not independent entities, but all are subjected to the same physiologic urge. Manifestly, if a condition of achondroplasia supervenes early instead of at about the age of 22 years, not one but all structures must be involved to a greater or lesser degree. If no septum nasi were ever intended to develop, it is conceivable, all things being equal, that physiologically, both sides would develop equally.

Again, if there were no driving force, there would be no particular length to the nose. One great element enters into this drive—civilization. The human head is the index. This being true one structure in particular is the sufferer. As the cranial cavity is increased in size to accommodate the physiologically enlarged brain, the downward and forward pressure on the septum, which is locked in by the bones of the face and the hard palate, must of necessity try to make its escape anteriorly or do the next best thing deviate or crumple. With higher civilization comes comparative ease of development this may be exemplified by the better preparation of foods. Mastication is as normal?

an act as walking and is just as essential. From the instant an infant suckles, all motions concerned in the obtaining or preparation of food for the gastro-intestinal tract should tend to keep the hard palate down, or at least but a little above the level of its periphery. The beneficial action of strong pressure along the alveolar processes, the result of a resistant body being crushed between the upper and lower jaws by the mighty force exerted by the muscles of mastication, appeals to all as being not only a logical but a highly scientific engineering feat in keeping the center of the arch down. If this natural process is allowed to work itself out after the arch has been held down by suction during lactation, with the appearance of the temporary teeth a combined action is instituted. All the deciduous teeth (twenty in number, or ten in each jaw) have made their appearance at about the second year. A gradual migration of the permanent teeth begins at about the fifth or seventh year and continues up to about the seventeenth or twenty-second year. There are thirty-two permanent teeth, sixteen in each jaw. Therefore, a grand total of fifty-two teeth have been born, raised and sent forth to labor. From two blocks of bone, the superior maxillae, half of this number have been derived, but their places to a certain extent have been replaced by the antrums. About the time the permanent teeth have completed their eruption, the frontal sinuses have reached their normal size. The sphenoid is demonstrable about the time the permanent teeth start to erupt. From the foregoing statement, it might seem that an indictment of the nasal septum is sought. To the contrary, it is sought to free—almost to exonerate—the nasal septum by removing it from the jurisdiction of the court of errors. The great hue and cry has been, "Don't destroy the vital center or centers of ossification by performing a submucous resection of the nasal septum in a person under 15 or 16 years of age." The ethmoid ossifies at about the end of the seventeenth year, the vomer, composed of two parallel plates, completes its union at about the fifteenth year, but the perpendicular plate of the ethmoid unites with the vomer at about the forty-fifth or fiftieth year of age. How long, then, shall one wait?

Trauma still stands high in the category of causes for deflected septums, but this must of necessity be hearsay to a great extent, for no normal child goes through life without a few falls. There is, however, another form of trauma that may be somewhat of a determining factor, namely, trauma at birth. Even under the most ideal circumstances, more than a third of all normal infants show wobbly eyes (nystagmus) at birth, as a result of cranial compression. It must be remembered that at birth the cranial base is relatively rigid and the nose comes in for its share of pressure, normal or otherwise. The nasal septum, although highly flexible, certainly has at least a squashing if not a breaking point. No doubt, some of the massively thickened

septums are thus caused. As no intranasal examination is ever made at birth, data as to any intranasal injuries at birth are not available. Both the eyes and the ears have been the objects of special examination at more or less frequent intervals after birth.

When nasal breathing is faulty, there supervenes a catarrhal process of varying degree of the mucous membrane, and by extension the lining membranes of the accessory sinuses may become affected. The latter condition is augmented by faulty ventilation. In the nasopharynx, the eustachian tubes become involved, causing an ascending inflammation of their linings and a consequent catarrhal otitis media—a beginning catarrhal hardness of hearing. When drainage is interfered with, mucus or mucopus passes backward, bathes the posterolateral walls and may cause an otitis media suppurativa, either acute or chronic. Other lesser conditions are epistaxis, due to drying of the discharge followed by formation of a scab, granular pharyngitis alone or with some acute lateral pharyngitis simulating tonsillitis, aches, pains, malaise and fever. The last mentioned condition is seen most frequently in children already tonsillectomized. The untoward effects of accumulated mucus or mucopus are to be noted not only in the immediate neighborhood of the nasopharynx. Children are prone to swallow all discharges rather than to expectorate or try to get rid of them by ineffectual blowing of the nose, even if old enough to attempt it. Thus, a train of gastro-intestinal symptoms makes its appearance, such as anorexia, anemia, inability to gain in weight, listlessness or general lack of interest during the day and restlessness and fitful sleep at night. The foregoing symptoms may grudgingly yield to much medication and much regulation of diet. The “adenoid facies,” although not as marked as before the operation on the tonsils and adenoids, does not improve as it should, the patient is not a perfect nose breather. Lung capacity is frequently restricted, and the inspired air passing directly through the mouth into the lungs may set up various inflammations. The situation is still further complicated by the accumulation of mucus or mucopus in the laryngopharynx, which has a tendency constantly to seep into the larynx and trachea, not infrequently causing violent paroxysms of coughing. A slight fever may or may not be present.

If the result to be obtained by performing a submucous resection is borne in mind, fewer radical operations would be performed even in adults. The objects for doing a submucous operation are (*a*) to facilitate true nasal breathing, (*b*) to facilitate natural nasal drainage and (*c*) to facilitate both nasal breathing and nasal drainage thus insuring better ventilation of the accessory sinuses and tympani.

Let us consider, therefore, a plan not only to satisfy all concerned but to justify surgical intervention when the septum is causing marked obstruction to nasal breathing in young persons. As already noted,

this operation is far from being as radical as that in the adult. The inherent difficulties due to the smallness of the nasal cavities are self-evident.

All the instruments, however, are of regulation size except the Jansen-Middleton forceps, which is one-third smaller. Instruments for the removal of the septum should be biting forceps and preferably a through-and-through biting model.

TECHNIC

Pure epinephrine is applied by means of a long, thin layer of cotton on each side of the nasal septum, and is allowed to remain in place for from twenty to thirty minutes. Before ether is administered, these strips of cotton are removed. A suitable tampon of gauze with a strong silk suture in one end is inserted into the nasal chamber, on the same side on which the incision is to be made, and packed posterior to the junction of the anterior and middle thirds of the nasal septum. The suture referred to is allowed to hang outside the nose toward the corresponding ear. The postnasal plug is not used. The usual incision is made in the convex surface of the septum. Instead of a knife, a fair-sized, sharp curet is used for cutting through the septal cartilage. The space thus obtained gives freedom of movement for separating the mucous membrane of the opposite side under direct visual guidance. The separation of the membrane on the concave side may be dispensed with entirely, as will be noted later. If both mucous membranes are separated, the next step is to remove a strip of cartilage and bone from before backward, as far as necessary, and this means including the ridge and spurs as far back as necessary.

The height to which cartilage and bone is to be removed will depend on the degree of deflection of the septum. The amount of tissue removed should be a little more than that of the tissue which is to replace it. The next stage is the replacing, transposing or transporting the septum to its new location. There is some space below, and if the curet for cutting through the septal cartilage is fairly large, there is space anteriorly. The new septum-to-be can move in two directions, downward and forward.

The cartilage can be taken care of in several ways. First, if the deviation is only moderately high, an incision from behind forward is made in the concave side but not completely through to the convex side. This allows of what might be termed a "pseudo green-stick fracture" when pressure is exerted on the convex side. If the deviation, however, is so high that this is impracticable, then three or four incisions completely through the cartilage, from below upward, almost to the dorsum and close to one another, may be made, forming three or more vertical fingers of cartilage. Superficial nicks are made in their points of greatest concavity. Packing is placed in the nose on the side of the convexity only, this allows the membranes to become adherent, thus holding them in place permanently. In other cases, when it is too tedious and would cause too much trauma, the membrane on the side opposite the incision is not elevated, but transfixed with the cartilage and both swung into place. This must be done posteriorly to the primary incision. In other instances, when a long bowing of the cartilage is present, an oblique incision on the concave side from above downward and forward may be made. This incision goes through the cartilage but not into the mucous membrane on the convex side. This also allows moving the cartilage to the midline. It is not necessary to remove cartilage in proximity to the dorsum of the nose or the perpendicular plate of the ethmoid. The former requires sup-

port, and the latter will give no support, as it shelves from above downward and backward. The perpendicular plate of the ethmoid should not give great concern. Like all bones in children, it will bend markedly before breaking completely. If the subject is young and sufficient space has been made inferiorly, in many cases the perpendicular plate in the course of a few weeks or months will assume a real perpendicular position, due to the constant traction of the contracting mucous membrane. If deemed necessary, the plate is grasped firmly with flat-bladed forceps, without the least semblance of twisting or rotating above the point where it is grasped, gentle, firm and slow force is exerted to cause a slight solution of continuity on the side of the concavity. A piece of Bernay sponge cut to fit is then inserted opposite the convexity and left in place for two, three or more days. After the first day, a few drops of one of the mild antiseptics is instilled once a day for cleansing purposes.

One other form of obstruction not infrequently gives trouble, namely, subluxation of the septal cartilage. If the condition is looked on not as a result of trauma, but as an abnormal or double septum, the problem is not so grievous. The usual incision is made, and the "wing" of cartilage corresponding to the side of the incision is removed to considerably above the respiratory space. The "wing" on the opposite side is undermined and sufficient is removed inferiorly to allow it to be swung to the middle line and to be able just to rest on the lowered ridge of the septum. Resilience is overcome by a superficial cut into it on the side opposite the initial incision. The side opposite the incision is packed firmly to hold the "wing" in place, and light packing may be put into the same side.

DANGERS

No tissue should be removed in the region of the junction of the lower lateral cartilages and the septal cartilage nor the junction of the septal cartilage and the perpendicular plate of the ethmoid high up, as the latter shelves backward from above downward. This is extremely important. Neither a rocking forceps nor a swivel knife should be used to remove the septal cartilage. The initial incision should not be too high nor too far back. Great care must be used to avoid the formation of hematomas, abscess is disastrous.

CONCLUSIONS

- 1 There is a positive need for some form of relief from obstructed nasal breathing in children before the age of puberty.
- 2 The form of relief must be along normal physiologic lines.
- 3 No interference with the normal growth of parts is justifiable.
- 4 The delegating of one part to do the work of another part never produces a normal physiologic result. Mouth breathing can never successfully supplant nasal breathing.
- 5 Removal of aberrant or excessive tissue does not interfere with the normal functioning of the primary stock.
- 6 No person not well qualified to perform the classic operation in the adult should attempt the operation in a child. Unfavorable results must follow.

7 The best guard against sinusitis is perfect drainage, this is attainable only by means of the physiologically perfect nose

8 Healing is dependent largely on normal air pressure within and without the middle ear, and obstructed nasal breathing militates against such a state

9 A septal operation is preferable to an operation for pansinusitis

10 The modified submucous resection of the nasal septum complies with the foregoing statements

ABSTRACT OF DISCUSSION

DR FRANK B KISTNER, Portland, Ore The contention that cephalic development produces changes in the structure and lays the foundation for deviation of the septum always seemed to me to have its weak points I was much interested two or three years ago in reading an account of the researches of Dr Hurd on this subject He began his researches with the embryo and followed them by work on the fetus and on infants and young children, and proved conclusively, at least to his own satisfaction, that deviations of the septum are laid down in the embryo He looked for material to back up his argument and selected patients in whom the septum was gone below the palatine fissure and there was no support at the bottom, he found that these patients did have deflection in the horizontal or perpendicular plane

A few years ago when we looked forward to orthodontic procedure to relieve us of the necessity for operating on children, I was quite enthusiastic about it The results were disappointing, and if Hurd is right that may be why we were facing the situation of basing orthodontia on the wrong hypothesis My own experience in operations on the septum in children has been limited It has been confined to the more extreme cases I have seen no ill results following the operations that I have performed, and yet today I always approach this operation with a certain amount of timidity

DR A D McCANNFL, Minot, N D I have always felt that it is not good practice and a dangerous procedure to operate on a growing child on account of disturbing the ossification centers My experience with submucous resections in children is limited to a few extreme cases, especially those of an anterior vertical deviation I have never interfered with the vomer However, Dr White has brought up a question that will start all of us thinking seriously as to the wisdom of this procedure in these troublesome cases of recurrence of obstruction in the breathing in children whose tonsils and adenoids have been removed In the past many have attempted to obtain these results by removing the free borders of the turbinates, which I think is a poor surgical procedure, and is only mentioned to be condemned

The essayist's description of the operation itself was not quite clear to me, and I would like to ask whether he does not have trouble in keeping the cartilage in place, following the slitting and thinning of the convex portion of the deviation I have always felt that to get a good result it was necessary to remove all the deviated cartilage so that there would be no deviation of the cartilage that would require pressure to bring it into place during the healing process

DR WENDELL C PHILLIPS, New York Dr White has changed some of my preconceived ideas as to the wisdom of operating on the deflected septum of young children There is no question as to his results, because he has carried on this work in a most scientific manner backed up by reports of a large number

of cases. I am inclined to think that in selected cases this operation will prove of extreme value and hope that it will be taken up seriously.

There seems to be little actual destruction of tissue in this operation. It must be true that the relief gained will permit the child to develop with less tendency to diseases of the sinuses and throat and the infections that keep the adenoid tissue from recurring from time to time.

DR LEE W. DIAN, St. Louis. It seems to me that there are in certain instances definite indications for operation on the septum in very young children. In a case of systemic disease with a paranasal sinus disease which will not yield to treatment, in which the nephritis or some other disease is secondary to the sinus trouble, it seems to me that in that instance operation on the septum is justifiable. On the other hand, I feel that only in a large hospital service will it be necessary to operate in more than two or three cases in the course of a year. It seems to me that, with the sinus infections which are present and which sometimes can be eradicated without operation on the septum, if these sinus infections are treated, if the endocrine disturbances which are so often present and exert an influence on the nose so as to interfere with nasal breathing are corrected and if the allergic question is gone into and the adenoids removed, in a majority of cases with some simple treatment of the mucous membranes and with the development of the head, the nasal breathing will become quite normal and operation on the septum will not be indicated. In short, in my judgment, before operating on the septum one should do everything possible to bring about normal breathing. Not only should the local condition in the sinus and the nasopharynx be gone into, but the general condition of the patient should be investigated carefully, the allergy and the endocrines, and the diet should be studied, for all these things have an influence on nasal obstruction.

DR GEORGE L. RICHARDS, Fall River, Mass. I have always been timid about attacking the septum in young children. I have tried out a simple procedure which does not interfere with the development of the septum and at once provides nasal breathing. A submucous resection, if required, can be done several years later. This operation, which is done under general anesthesia, consists in separating the anterior base line of the cartilage from its attachment to the nasal process of the superior maxilla by means of a narrow thin chisel and the making of one or two vertical cuts through the cartilage at its point of greatest convexity. This removes the elasticity of the cartilage which can now be easily shaped with the finger and straightened. No portion is removed. A Kyle hollow malleable splint, of as large a size as is freely and easily introduced, is now introduced on the convex side. This remains unchanged for two or three days, when it is removed for cleansing. It is replaced and thereafter changed daily. It is borne without pain. A smaller size may be required a week or so later. I try to have this splint worn for from three to four weeks, at the end of which time complete healing of the cuts has taken place. The cuts are preferably made obliquely to the plane of the septum. I have followed some of these cases for several years, and nasal breathing has continued through the previously obstructed side. This operation is not as thorough as that of Dr. White but has answered the purpose well and has the advantage that no portion of the septum is removed and that there is no interference with the future development of either cartilage or bone.

DR EDWIN MCGINNIS, Chicago. Dr. Dean emphasized two sorts of cases that do not really require surgical intervention—the allergic case and the case due to faulty feeding. Another group of cases actually requires surgical intervention, and I, like everyone else, have been worried about what would happen

to the noses in these cases. I have used the same technic in operating on children as I have on adults. The youngest child I operated on was 4 years of age. I performed the operation under general anesthesia, but I worried year after year as to what would happen to the nose. I followed the case for ten years, and nothing developed, the nose has not been operated on again, the septum is straight, and the child has good nasal breathing. Last year I had as a patient a child who had lost his hearing, on examining the nose, I found infection of the nasal sinuses and a thickening of the cartilage of the septum, it seemed urgent to do something for this patient in order to help his defective hearing. All of the allergic states and the diet were investigated. I did a rather high submucous section and infracted the middle turbinates. With inflation of the eustachian tube and follow-up treatment, this child regained his hearing. I have tried to preserve the septal cartilage, in two or three cases I went too far back, and as years went by, with the growth of a cartilaginous septum bulging appeared to the convex side, which produced obstruction. I usually make my incision through the soft parts and then make the cartilaginous incision farther back. In three cases, I made the incision too far back and got a deflection of the cartilage from further growth. I will have to do a subsequent correction to get rid of the obstruction.

DR LYMAN G. RICHARDS, Boston. My earliest recollection of the science of rhinology was a septum operation on myself, by a most efficient rhinologist, done not under general but under local anesthesia. That, however, was before the proposed use of the Kyle splint which in my hands has been a rather unsatisfactory procedure. It is a difficult thing to maintain replaced cartilage in position, owing to the extreme tension and elasticity of the cartilage, particularly in children, my experience has been that the use of the Kyle splint over a long period results in a good deal of nasal suppuration and has to be given up, and that after a while one will find that there has been a return of the position of the cartilage. I have had a good deal of success in such cases in letting the cartilage alone and in not attempting violently to fracture the maxillary rod which carries the lower end of the cartilage to the opposite side. It may not straighten out, and it may result in increased stasis in the inferior meatus. Under those circumstances, it may be necessary to do a subsequent submucotomectomy.

I agree with Dr. Dean that many of these patients may get well without operation, but when parents bring a child with the statement that there is a tumor in the nose, and one hopefully looks for some unusual growth and finds complete closure of the nasal lumen on one side, it seems to me to be in order to restore nasal function. One point of Dr. White's paper is the multiplicity of incisions over the cartilage. This comes nearer to breaking up the tension that interferes with the permanence of the central position of the septum than anything else.

DR NATHAN P. STAUFER, Philadelphia. I do not know just what Dr. White means by "children," whether he means subjects of a certain age or not. I work with 1,600 boys, from 6 to 18 years of age who live in one place. I have done more than 100 submucous resections, and I have seen no ill results. A tonsillectomy is usually done first, because if the submucous resection is done first tonsillitis often follows and then the tonsils must be removed later. A local anesthetic is used. The patient is placed in the supine position, and cocaine, 1 per cent, and 1:1,000 epinephrine hydrochloride are used. No tetany has been seen. The septum should be entirely removed, except for a small bridge. As Dr. Kistner said, if the old Ash operation is done, there will probably be a return. I have never found anything satisfactory for holding the septum without taking out the entire deviation.

DR FRANCIS W WHITE Regarding holding the cartilage in place, if a definite amount is removed from below, then a few incisions made in the concave side and pressure is made on the convex side, one will get practically a green-stick fracture. There is solution of continuity of surface of the concave side, while on the convex side there is continuity of surface. That is what I mean by making the incision so as to reduce the resilience of the cartilage, thus allowing it to be put in its new position and held there. These operations have been done over a period of nine years, and in none of them have I seen the necessity for doing a secondary operation. The breathing space has been sufficient to allow for any pressure that may be required to bring the septum into the middle line. As to Dr Dean's attitude, I agree that many patients will get along well without operation. This operation is one of necessity. Dr Stauffer spoke about the age. The youngest child was 4 years of age, and the oldest 15, an average of 9+. Tonsillitis frequently occurs after a submucous operation if the tonsils have not been removed first. We do not do a submucous resection, in children particularly, with the tonsils in situ. In answering Dr McGinnis, in the cases referred to, the deviation was high. One cannot reduce the resilience by high removal of the cartilage without danger to the bridge. The incision or incisions should be made almost up to the dorsum. Then little nicks are made on the concavity, and when one presses on the convex side one produces a green-stick fracture, and in a week or ten days the shape will be perfect.

I do not leave the packing in over a week or ten days. If I see the least tendency of the cartilage to snap back, I repack.

To those who wish to do this operation on children, I would suggest that they do not start with very young subjects.

ALLEVIATION OF PAIN IN PERITONSILLAR ABSCESS

REPORT OF A METHOD INVOLVING COCAINIZATION OF THE PALATINE
NERVES PASSING THROUGH THE SPHENOPALATINE GANGLION *

M REESE GUTMAN, M D
CHICAGO

Any one who has suffered the agonizing pain associated with a peritonsillar abscess or who has had occasion to observe those so afflicted can well understand the reason that prompts a search for some method of alleviating the pain. Until relief has occurred by incision or spontaneous evacuation, these people suffer untold agony and in addition are unable to open the mouth, chew or swallow. Consequently they are exhausted not only because of the persistence of the excruciating pain and its ensuing insomnia but also because of the deprivation of food and water. Frequently the pain is so great and the inability to open the mouth so pronounced as to prevent the physician from making a proper examination or performing the necessary incision. The only relief to date that one may offer to those with this condition has been the obtundation of the pain by various analgesics and narcotics, and not infrequently these are but of little value.

Pain broadly speaking may be alleviated in three different ways (1) by obtunding the local area in which the pain impulses originate (2) by obtunding the transmitting mechanism including the various nerve trunks and their associated sensory ganglions and (3) by obtunding the central perceptive areas in the brain. So far the last has been the point of attack by the use of the various analgesic and narcotic medicaments. In local areas of marked inflammation the use of cold or heat to improve the circulation and relieve congestion is all that can be offered. The local injection of obtunding solutions is impracticable for two main reasons. First, there is danger of spreading an existing infection and second it is well known that the efficacy of a drug producing local anesthesia is reduced to a minimum and even may be ineffective when injected into an inflamed area. As the use of various drugs to obtund pain in the conscious centers has not been so successful and local injection cannot be utilized there remains but one other point of attack, namely, the conducting nerve trunks and their associated ganglions.

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The anesthetization of nerve trunks and ganglions in surgery is too well known to require any comment. The tendency in local anesthesia to employ injection into specific nerves or their ganglions in order to effect an anesthesia in the area which they supply, rather than a wholesale infiltration of the region in question is also common knowledge. In certain types of neuralgia injection into the nerve trunk or its sensory ganglion to obtund pain is an accepted procedure. Injections of alcohol into the various branches of the trigeminal nerve or the semilunar ganglion for relief from pain in tic douloureux are common occurrences. More recently the use of paravertebral injections in angina pectoris and other painful conditions is becoming more popular.

Relief from pain in the peritonsillar area by such methods requires a consideration of the nervous mechanism supplying it. Roughly speaking the nerve supply has its origin from the palatine branches of the fifth nerve and the tonsillar branches of the glossopharyngeal nerve. The upper two thirds of the tonsillar area is supplied from the palatine nerves and the lower third from the glossopharyngeal. The descending palatine nerves arise from the trigeminal and pass through the sphenopalatine ganglion. This ganglion also known as Meckel's or the nasal ganglion lies in the pterygopalatine fossa of the sphenoid bone just behind and lateral to the posterior extremity of the middle turbinal of the nose. Coursing directly down from the pterygopalatine fossa is the pterygopalatine canal. This canal contains the palatine nerves that come from the sphenopalatine ganglion and make their exit through the palatine foramina that is located just 4 mm medial to the last molar tooth. From here the posterior and middle branches course downward and are distributed to the upper two thirds of the tonsillar area.

It so happens that the pathologic process in peritonsillitis and peritonsillar abscess formation is located in the loose areolar tissue that binds the tonsil to its enveloping pillars and practically always in the upper and anterior portion of the peritonsillar area. This area, as has been shown is innervated by the palatine branches of the fifth nerve that passes through the sphenopalatine ganglion. Therefore, blockage of the nervous impulses along this route will effectively relieve pain resulting from peritonsillar inflammations and suppurations. Furthermore, it will anesthetize the site of the region in which the classic incision for peritonsillar abscess is made. This nerve block may be conveniently performed in two places. First, it may be performed in the region of the exit of the palatine nerves from the posterior palatine foramina. A needle puncture 4 mm medial to the last molar tooth will enable one to deposit fluid in and about the nerve trunks to effect an anesthesia. This is not infrequently performed in local anesthesia for tonsillectomy. But as the site of the puncture is always affected

in peritonsillar infections it cannot be used for this condition. Second, injections into the nerves may be performed (by the way of the nose) as they pass through the sphenopalatine ganglion. If one takes a long needle and introduces it into the nose in such a manner as to cause the point to enter the lateral nasal wall just behind and lateral to the posterior end of the middle turbinate and points the needle toward the cheek, it will enter the pterygopalatine fossa in which the ganglion and the connected palatine nerves lie. The deposition of a local anesthetic fluid will effectively anesthetize the area supplied by these nerves. The ganglion and the associated nerves usually lie close to the mucous membrane of the nose and it has been found that even a topical application of cocaine to the mucous membrane in this region will effectively anesthetize these structures by diffusion of the cocaine through the mucosa. Advantage has been taken of this fact to cocaineize the ganglion or medicate it in cases of a peculiar type of unilateral headache known as Sluder's syndrome. This unilateral pain of a characteristic distribution is relieved within a short time after topical application of cocaine to the region of the mucosa overlying the sphenopalatine ganglion without the necessity of an injection. It follows that the nerves may be affected at the same time.

Several years ago I was confronted with a case of severe peritonsillitis. The pain was so excruciating as to prevent the patient from opening his mouth to permit inspection. In order to open the abscess it was thought necessary to resort to a general anesthetic, but the patient demurred and inquired if local anesthesia could not be employed. Just preceding him a patient with a typical Sluder's syndrome had been treated by topical application of cocaine to the region of the sphenopalatine ganglion, and the thought occurred that the palatine nerves could be anesthetized in this manner to permit incision of the abscess. This was tried and to the surprise and the delight of the patient not only was the pain relieved after a short period of time but he could open his mouth and drink a glass of water, the first in three days with but little discomfort. The incision however was not entirely devoid of pain but was less than that usually observed. During the past two years there has been occasion to try this method in twelve more cases. The uniform alleviation of pain and discomfort that accompanied the topical application of the cocaine to the region of the sphenopalatine ganglion was gratifying.

TECHNIC

Under good illumination preferably with a head mirror and reflected light, a nasal speculum is introduced into the anterior nares of the side affected. A cotton-tipped applicator dipped in a 10 or 20 per cent solution of cocaine is introduced into the nose under inspection until the tip lies just behind the posterior end of

the middle turbinate. The portion of the applicator in the hand is turned toward the median line so as to point the cotton-tipped portion against the lateral nasal wall. It is firmly held in this position for several minutes until the desired relief is obtained. In cases in which the middle turbinate is large or bulbous, it may be necessary to bend the applicator so as to fit in the region desired. This may also be necessary in the presence of a crooked septum.

CONCLUSIONS

1 Peritonsillar infections for the most part are located in the areolar tissue in the anterior and superior portion of the tonsillar area, between the so-called tonsillar capsule and the pillars.

2 This region is innervated by the palatine branches of the fifth nerve that pass through the sphenopalatine ganglion.

3 The ganglion and the associated palatine nerves may be effectively anesthetized by the topical application of cocaine against the lateral nasal wall just posterior to the posterior end of the middle turbinate.

4 Pain in peritonsillar infections may be controlled in this manner and a practically painless incision for peritonsillar abscess may be performed by its use.

NOTE.—My attention has been called to the fact that Hoople of Boston has described this method previously, and I therefore wish to credit him with the priority in its use.

IS STUTTERING A MEDICAL PROBLEM?

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At present, the treatment of persons who stutter is for the most part in the hands of laymen, either honest but unversed pedagogues or downright charlatans—the “stammering schools.” In some of the larger cities, the board of education has a speech improvement department. At the head of this department is a layman, who not infrequently holds the position by virtue of political influence and the actual treatment is carried on by the regular school teachers, who may or may not have had any special instruction in disorders of speech. If they have been fortunate enough to have taken a post-graduate course, this has been in the department of elocution or public speaking of some college. Nowhere has it been demonstrated to them that they are dealing with a pathologic entity, a neurosis. Consequently, they regard stuttering as a phonetic disturbance, which it is not. So much for the sincere but mistaken pedagogues.

The “stammering schools” are of two kinds—residential and correspondence. Both are characterized by the “cure guaranteed” method. Their literature is full of testimonials. Not infrequently the quack in charge of the school is the author of a ponderous book on the cure of stuttering, privately printed, of course, and nothing more than an advertisement for his school. The method of treatment is usually a new discovery held as a great secret. These schools are thriving and becoming more and more prevalent for publicity pays. On such stuff the victims of stuttering are fed.

The fault lies mainly with the medical profession and with the institutions of learning. I know of no medical school in which the subject of disorders of speech is considered a part of the curriculum. In fact, they are not even mentioned. Surely, if physicians disregard this condition as a medical problem, they cannot expect the laity to do differently. As a result the persons affected turn to the school teachers and to the fake “stammering schools.” In this paper I shall try to show that stuttering is a medical condition, a disease and intelligent treatment can be given only under the supervision and direction of the physician. As soon as this is realized, the frequency of stuttering will be diminished, and this too long neglected subject will begin to be placed on a scientific basis.

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CLASSIFICATION OF SPEECH DISORDERS

Disorders of speech may be classified under two general headings (1) stuttering and stammering and (2) defective phonation. Under the head of defective phonation are included aphasia, lisp, persistent infantile talk (baby talk), nasality, hoarseness, falsetto voice, imperfect pronunciation, phonasthenia (voice fatigue), lalling, undeveloped or retarded speech, perverted speech (idioglossia, coprolalia, echolalia), negligent speech and foreign accent.

STUTTERING AND STAMMERING

In Europe, especially in Germany, these two conditions are differentiated. Stuttering is considered to be difficult speech, and stammering incorrect speech. In this country, the former is associated with the reduplication of sound and the latter with hesitation in speech. Other writers distinguish between these conditions by attributing one to failure in pronouncing the consonants and the other to failure in pronouncing the vowels. None of these distinctions are true. One finds in the same person reduplication and hesitation and failure to pronounce both the vowels and the consonants. As the etiology, pathology, symptomatology and treatment are alike in both conditions, I feel warranted in considering stuttering and stammering synonymous terms.

Etiology—Heredity is an important factor, for it is undoubtedly true that stuttering is found in succeeding generations, but this must be distinguished from what is imitation from contact and what is really due to a neuropathic taint. Temperament and emotional instability are causes to be considered. Even a casual study of a group of stutterers will reveal disorders of personality. These persons are hypersensitive, introspective, morose, shy, easily excited, hyperactive, secretive, melancholy, suspicious, overanxious and absent-minded, and they present inferiority complexes, behavior disorders, sexual perversions and anti-social traits. These may be considered in the nature of predisposing causes. Then there are the exciting causes: mental shock and psychic trauma. In addition there is a general muscular spasticity. The psychanalysts think of stuttering as the outward expression of an internal conflict. Considering all this, stuttering may be defined as a spastic coordination neurosis based on a mental conflict.

Symptoms—The stutterer betrays himself as soon as he speaks. The character of the defect is not constant, but depends on the emotional status at the time. A stutterer does not always stutter on the same sound, though the most common ones are the labials, *p*, *b*, *m* and *w*. There are special forms of stuttering, such as inability to begin, inability to introduce, hesitation, reduplication of sounds, inability to telephone, inability to speak certain words, inability to speak when suddenly

addressed, failure in the middle of a conversation and the use of starters, such as "ei," "eg," "yes" and "well."

The breathing is jerky, or the person may be speechless. This is due to the spasticity of the abdominal muscles and the diaphragm. The presence of the hard monotone is due to spasm of the laryngeal muscles. Failure on the sounds *p*, *b*, *m* and *w* is caused by spasms of the lips, and failure on the sounds *t* and *d* is caused by spasms of the tongue. Tics and facial grimaces are due to spasms of the muscles of the face. The rapidity of speech is caused by nervous anxiety.

Finally, there are some characteristic physical symptoms: an exaggerated dermatographia, flushing of the cheeks, an increased pulse rate on talking and a further increase on stuttering, a high systolic blood pressure, arrhythmia, cardiac palpitation and profuse perspiration.

Examination—Every stutterer, if he is to be treated scientifically, should undergo a thorough examination consisting of (1) the obtaining of the history, (2) and a physical (3) mental, (4) vocal and (5) phonetic examination. It is obvious that the history must be obtained and the physical examination made by a physician. The mental examination may be made by a trained physician or a psychologist, and the phonetic examination by a physician, a psychologist or a teacher. The rendition of this examination alone demonstrates that stuttering is a medical problem.

A complete history is of prime importance in determining the heredity and the nervous background. Any history that does not cover three generations is of little value. The developmental period, previous illnesses, injuries, operations, habits and school progress should be investigated. A study of the home and social environments is important.

The physical examination may bring out an underlying cause of the speech defect. A right hemiplegia suggests a lesion involving Broca's area and producing aphasia. Hemiatrophy of the tongue will produce difficult articulation. Deafness is another cause of inability to speak properly. Endocrine dysfunction should be investigated. How can a layman find these conditions?

In the vocal tract there are numerous possible causes of defective speech. Though stuttering is primarily a mental affliction, there are physical factors that may act as aggravators, unless these are removed, cure is impossible. The most common aggravating factors are intra-nasal obstructions, hypertrophied tonsils, adenoids, laryngeal neoplasms, paralysis of the vocal cords, tuberculosis and syphilis of the larynx, otosclerosis, aural discharges, high, narrow, arched or cleft palate, velar insufficiency, prognathism, intrusion or obtrusion of the dental arches, improper activity of the upper lip, a short under lip, harelip, tongue-tie, tumors and paralysis of the tongue, a short, elongated or abnormal uvula and overshoot or undershoot jaws.

The phonetic examination consists in determining the sounds on which the stuttermeter fails. The following scheme is comprehensive

- 1 Labials *p b m, w, wh*
- 2 Labiodentals *f, v*
- 3 Linguadentals *th* (soft), *th* (hard)
- 4 Anterior linguapalatals *n, t, d, l, g* (soft) *j, s sh zh*
- 5 Posterior linguapalatals *g k c* (hard), *ng* *ɳ*
- 6 All the vowel sounds *a* as in lace, as in bare, as in flat, as in flaw, as in star, as in amid *e* as in weal as in less *i* as in will as in bird *o* as in boot as in book as in note *u* as in stub

TREATMENT

The treatment is based on a comprehension of the etiology and mechanism of speech. In chart 1 there is a schematic representation of the normal speech reaction. There is a stimulus to speak. This

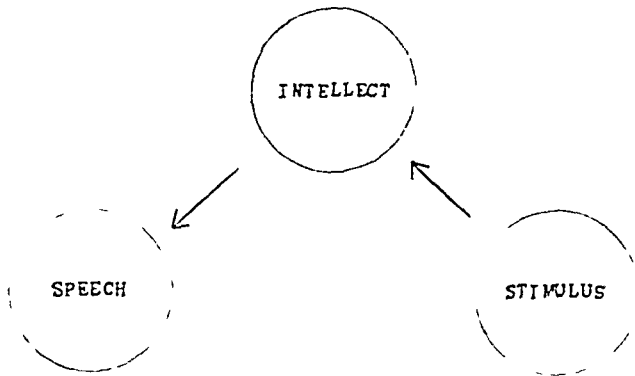


Chart 1—Normal speech reaction

travels along the afferent paths to the intellect and then along the efferent paths to the speech organs, normal speech is the result.

In stuttering there is an emotional instability affecting the speech zone area. This is represented in chart 2. The passage of the impulse is shunted, instead of reaching the intellect it travels uncontrolled to the speech organs via the emotions. The result is stuttering.

Assuming this mechanism to be true, the treatment must of necessity be directed toward overcoming or neutralizing the emotional obstacle. This is accomplished as shown in chart 3.

In stuttering, the treatment is a difficult and tedious task. The patient should be told at the outset that the situation is difficult, that a cure is possible, that the process is slow, and that improvement at the end of six months is a favorable omen. Treatment in classes may be necessary because of economic conditions, but the best results are obtained in private sessions. With this clear, one may proceed with the actual treatment which is medical, surgical, psychotherapeutic and reeducational.

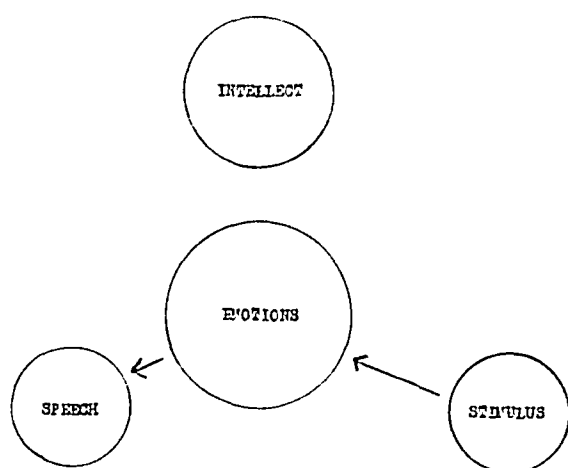


Chart 2—Speech reaction in stuttering

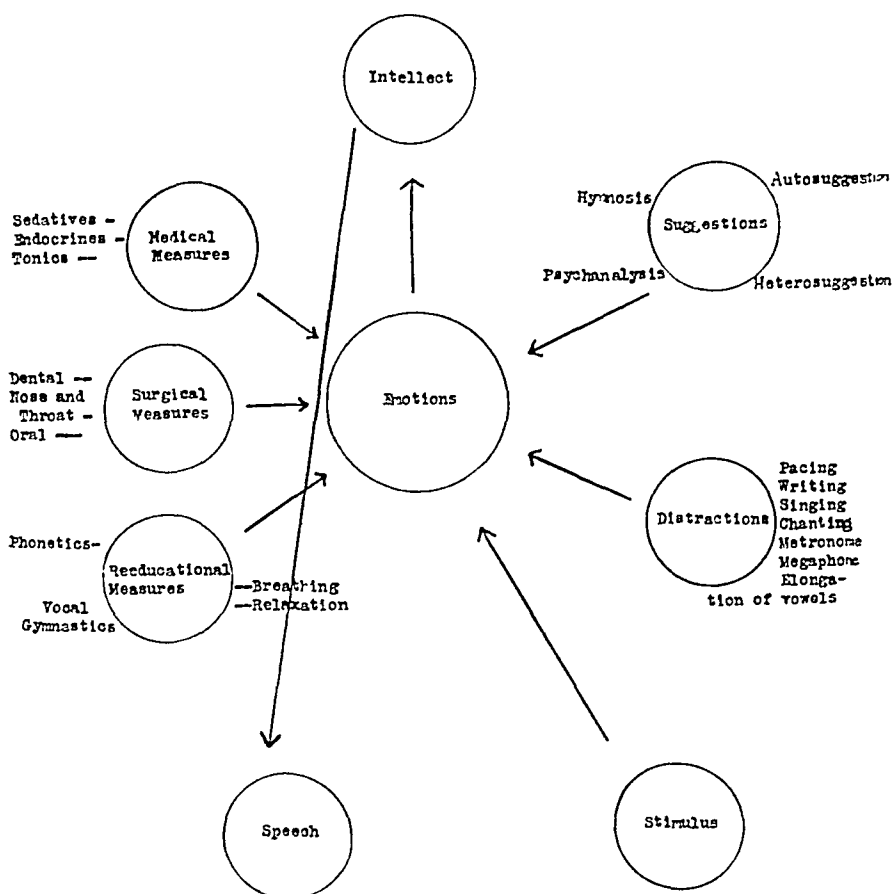


Chart 3—Treatment of patients with stuttering

Medical and Surgical Treatment—Emotional instability, tics, choreas, malnutrition, anemia and endocrine disturbances require the requisite medical attention. Speech is not an isolated process. We speak with our whole body and that which affects the whole affects the part.

Although as already stated, stuttering is a mental affliction, there are physical factors in the vocal tract which may aggravate the condition. These require the services of the rhinolaryngologist, the oral surgeon and the dentist.

Psychotherapeutic Treatment—Stuttering is a spastic coordination neurosis based on a mental conflict. To determine the nature of this mental conflict, which has long since been forgotten and lies buried in the subconscious mind, psychoanalysis may be employed. The nature of the conflict is discovered and revealed to the stutterer. The stored-up and suppressed emotions are liberated and through analysis a readjustment is established.

Suggestion is also useful in creating a spirit of self-confidence, something which the stutterer lacks. A knowledge of mental hygiene is necessary. By positive suggestion the stutterer is convinced that he can speak, that he is cured, that he is well.

Distraction is another form of psychotherapeutic treatment that can be used to advantage. The attention of the stutterer is focused on his speech. This attention can be distracted by various means, such as the metronome, the megaphone, singing, chanting, pacing, writing, elongation of vowels, change of voice and breath grouping.

Reeducation—The reeducational treatment is the only part that can be carried on by the teacher, but this teacher must be especially trained in physical training, vocal gymnastics, the anatomy and physiology of speech and the physiology of respiration. I classify this part of the treatment under these headings: (1) relaxation, (2) breathing, (3) vocal gymnastics and (4) phonetics.

Relaxation—When the stutterer begins to speak, he directs his attention to the process and becomes tense. The muscles contract, he stands rigid, the abdominal wall hardens like a board, the jaw is held tight, the lips are firmly compressed, the fists are clenched, the muscles of the cheek are taut and there is a spasm of the laryngeal muscles. Against this barrier of spasticity, he throws a flow of speech which comes out in a torrent of explosive utterances. Failure aggravates the situation and he may become speechless.

The first task is to break down the wall of spasticity and liberate the imprisoned voice. The muscles must be relaxed. To attempt reeducation in schoolrooms in which the children are told to sit at attention with their hands behind their backs or clenched tightly in a stiff position on the desk or lap is an absurdity and is productive of disaster.

Whether in the classroom or in the private office, efforts should be directed toward making the subject forget his existence. The best way to make the stutterer lose self-consciousness is to distract his attention. This can readily be done by the use of exercises in systemic relaxation.

Breathing—Stutterers may or may not breathe properly and defective breathing engenders stuttering, but the fact remains that stuttering nearly always causes wrong habits of breathing during speech. Most stutterers are clavicular breathers. There are spasmodic closures of the glottis. There are attempts to speak with the ingoing air instead of on the exhalation. The chest may be heaved and pressed down, the action of the diaphragm may be upward instead of downward, and the mouth passage may be obstructed by the position of the tongue. Not infrequently, the breath is taken in quick, hurried, "nervous" gasps. Other subjects take a full breath and then hold it, compressing it so tightly as to make it appear that they would explode before getting a chance to talk. All this is due to a nervous collapse of the normal breath control. Consequently, instruction in breathing, and breath control are necessary.

Vocal Gymnastics—Though stuttering is a neurosis it is often associated with improperly functioning articulators. The lips are spastic, the tongue unwieldy, the soft palate stiff and the muscles of the mouth and throat taut. Consequently, a secondary improper articulation or defective phonation is developed on top of the stuttering. Exercises directed to the tongue, lips and soft palate will help to correct this failure.

Phonetics—There is no primary phonetic disorder in stuttering. A stutterer can pronounce all the sounds when he does speak. The trouble lies in the process of speaking and not in the contents of the speech. However, bad habits of speech may be formed, and these require reeducation along phonetic lines. But to expect a cure by phonetic instruction alone, as carried out in the schools, is absurd. It may be dogmatically stated that the use of phonetics alone in the treatment of stuttering is harmful.

SUMMARY

Stuttering as a medical problem is neglected by the medical profession. It is for the most part dealt with by school teachers or by lay "stammering schools" of the advertising type. Stuttering, however, is a medical entity. It is a spastic coordination neurosis based on a mental conflict.

Speech disorders may be classified under two headings: (1) stuttering and stammering, which are synonymous, and (2) defective phonation.

The etiology of stuttering is threefold predisposing causes heredity and a neuropathic taint exciting causes mental shock and psychic trauma, and aggravating causes a pathologic condition in the vocal tract

Every stutterer should undergo a medical examination consisting of (1) obtaining of the history, and (2) a physical (3) mental, (4) vocal and (5) phonetic examination

The treatment is medical, surgical psychotherapeutic and reeducational. Psychoanalysis, suggestion and distraction are forms of psychotherapy employed. The reeducational treatment is directed toward muscular relaxation proper breathing vocal gymnastics and the correction of defective phonation

Stuttering is a medical problem the treatment of which requires the services of the medical speech specialist aided by the oral surgeon the rhinolaryngologist the orthodontist, the psychologist and the trained teacher of speech

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OTITIC ABSCESS OF THE BRAIN

REPORT OF A CASE, WITH SOME CONSIDERATION OF OPERATIVE
INDICATIONS OF MASTOID INVOLVEMENTS *

A KOVACS M D

MILWAUKEE

The outcome in a case of acute otitis media is a matter which every otologist agrees is difficult to prognosticate during the first days of the inflammation. Infections starting with violent manifestations often abate, while in cases of seemingly mild inflammations endocranial complications which necessitate surgical intervention unavoidably develop.

The establishment of a definite indication for surgical intervention and its accomplishment at the earliest possible moment are emphasized by every author who writes on the subject. The key to a successful outcome seems to lie in two factors: a definite indication for operation and judicious management of the pathologic process encountered. With an accurate knowledge of the anatomy, the technic of treatment in otitic abscess of the brain, and with few exceptions (deep-seated infections of the petrous pyramid and labyrinth) the management of other endocranial complications do not present special difficulties.

A proper indication for operation does not necessarily imply an exact diagnosis. Indeed, in most cases of endocranial complications it is impossible to establish the site of the pathologic process before operation. The clinical and laboratory observations on an extradural or subdural abscess, circumscribed leptomeningitis, encephalitis or abscess of the brain coincide in many points, while one complication is frequently found associated with others to confuse the clinical picture. Thus Borries¹ stated that every cerebral abscess produces more or less of a meningitis; sometimes it is so slight that it is revealed only by the microscope at autopsy.

To await the appearance of cardinal symptoms usually means the loss of the most propitious time for intervention. One cannot stress sufficiently the importance of a careful history in every case that is not seen from the onset. A chronic otorrhea, latent for years and apparently unworthy of notice, merely accompanied by seemingly insignificant sensations, for instance by slight giddiness on stooping the first time during the morning, is by no means an innocent affair. If an acute exacerbation occurs all doubt is removed as to the origin of the serious danger.

* Submitted for publication, Sept. 16, 1929.

1 Borries, G. V. The Diagnosis of Cerebral and Subdural Abscess by Lumbar Puncture. *Ann. d. mal. de l'oreille, du larynx* 47: 452 (May) 1928.

Even though the condition of the middle ear is seemingly of no importance, it may mask a serious underlying condition. Endocranial complications frequently arise without serious inflammatory conditions of the middle ear and mastoid process, without producing any visible lesion of the structures surrounding the ear.² Bárány³ warned that there may be a destructive process in the mastoid from an otitis media that has never even required paracentesis of the tympanum.

While the clinical symptoms are valuable, those not evident may be less so, for example a fully developed temporosphenoidal abscess may occur without any rise in temperature.

Considering acute inflammations of the middle ear with a view to operation, it must be recalled that every inflammation spreads as a collateral edema in a greater or less degree to even distant mastoid cells. Therefore, with every virulent otitis there usually coexists a suppurative mastoiditis, which may clear up without any surgical intervention, just as it often does in the middle ear cavity.

Tenderness is regarded as an indication for operation only in the later stages of otitis media. Neumann⁴ asserted that the older an otitis the greater the importance of a symptom. Bárány believed that the symptoms of an acute otitis media which call for an immediate operation during the third week do not have this significance during the first week.

The bacteriologic observations and anatomic configuration are important considerations in prognosis. The physician must decide the course quickly when infections with *Streptococcus mucosus* are discovered, as also when the roentgenograms show unfavorable pneumatosis, unevenly distributed, i. e., large cells in the periphery and small ones in the proximity of the antrum.⁵

Conspicuous reduction in hearing may be observed in conditions other than infection with *Streptococcus mucosus*. In one of my cases it was noticeable from the first day and caused me to be on the alert for the performance of an antrotomy.

Results of spinal puncture are often valuable although opinions differ as to their interpretation. Some consider as pathologic a fluid containing 3 cells per cubic millimeter while others accept 10 cells per cubic millimeter as minimum. The cerebrospinal fluid is not a true mirror of the changes within the cranium as the cellular and colloidal

2 Lund, R. Differential Diagnosis of Otogenous Brain Abscess. *Acta otolaryng.* **11** 479, 1927.

3 Barany. *Munchen med. Wchnschr.*, 1920 vol. 67.

4 Neumann, H. Zur Pathologie und Klinik der akuten Mastoiditis. *Ztschr. f. Hals-, Nasen- u. Ohrenh.* **20** 155, 1928.

5 Wirth, Erich. Mittelohrentzündung von bakteriologischen und anatomischen Einflüssen. *Ztschr. f. Hals-, Nasen- u. Ohrenh.* **18** 350, 1927-1928.

elements increase with the repetition of the puncture, daily examination thus proving fallacious ⁶

Neumann saw a case of fully developed diffuse purulent meningitis in which the cerebrospinal fluid gave negative results Yerger ⁷ came to the conclusion (155 cases of meningitis 43 cases of sinusitis, 35 brain abscesses, 8 cases of labyrinthitis and 4 cases of extradural abscess) that the spinal fluid is a reliable index of some of the intracranial complications of otorhinogenic origin a valuable adjunct in diagnosis and of definite value in the prognosis and treatment, but believed that it should not be relied on to the exclusion of other dependable clinical signs Lund ⁸ stated that in view of the great variability of the cerebrospinal fluid reliable information is obtainable only through a series of punctures

The diagnosis based on the roentgenograms must accord with the clinical observation During the first days of an otitis media the linings of the cells are filled with pus and are swollen and the roentgenograms show a haziness which in itself cannot be a decisive factor In unilateral change of the pneumatosis the cloudiness of the eburneous bone may be misleading No wonder Emerson ⁹ said that one should rarely consider operation on the basis of the x-ray picture alone The clinical picture and some one skilled in its interpretation are also necessary In another article the same author stated that if one relied on the roentgenogram alone, a great many mastoids would be operated on unnecessarily ¹⁰

If, however, one hesitates because of a negative observation in the x-ray picture, one courts disaster and risks the life of the patient To emphasize this I shall describe the x-ray observations two days previous to an operation in a case of abscess of the brain presently to be given in detail The mastoid consisted partly of cancellous bone and partly of large cells The spongy part was close to the posterior auditory wall and the large cells were in the tip and posterior part of the mastoid, while there was a slight haziness over the spongy part it was insufficient to indicate disease Would one not have delayed unnecessarily in waiting for a more positive roentgenogram?

6 Brunnings, W. Bemerkungen in Meningitis Frage Ber d. Gesellschaft Sachsisch Thuringischer Kehlkopf u. Ohrenärzte **11** 26 1927

7 Yerger, C. F. Cerebrospinal Fluid as Index of Otorhinogenic Intracranial Complications J. A. M. A. **85** 424 (Aug. 8) 1925

8 Lund, R. Diagnosis and Differential Diagnosis of Otogenic Cerebral Abscess, Hospitaltid **70** 695 (July 28) 1927

9 Emerson, F. P. Indications for Opening Mastoid Cortex, Boston M. & S. J. **186** 301 (March 9) 1922

10 Emerson, F. P. Roentgen Diagnosis of Mastoid Disease J. A. M. A. **75** 91 (July 10) 1920

Another case presenting a perplexing diagnosis was that of a girl who consulted me on account of an excruciating left-sided headache on May 14, 1927. The girl had acute otitis media six weeks previously, was treated in the hospital and was discharged after the condition in the middle ear had cleared up. Although a lusterless, reddened but not bulging drum was visible, and the mastoid process was normal in appearance, the drum was lanced under aseptic conditions. Two days later, pus found its way from distant mastoid cells into the middle ear. The opinion of the roentgenologist four days later was as follows:

The cell walls are still visible in the left mastoid but are rather cloudy. The mastoid tip is increased in density. The mastoids are not symmetrical. The right mastoid shows a very few cells but they appear to be somewhat more clear than the left. The cloudy appearance of the left mastoid cells suggests mastoid involvement without apparent destruction of bone.

An unusually sharp attack of pain was experienced by the patient during the next day. At operation a large sequestrum on the descending part of the sinus sigmoideus was found, while the latter was partly covered with granulation tissue. Large apical cells were found filled with pus, and there was free hyperemic dura behind the antium i.e., an extradural and perisinus abscess.

Although a topographic diagnosis is difficult or altogether impossible with the aid of every-day methods, the recognition of an endocranial complication is indispensable in order to evacuate the pus and check the spreading infection before the natural resistance is exhausted.

The pathology which might explain the clinical manifestations is often difficult to interpret in borderline cases. There may be doubt as to a slight alteration or discoloration of the organs, the change in consistence may require an experienced touch, drawing conclusions about a sinus wall or dura often surpass the average technic. To determine the presence of a parietal mural thrombosis, to ascertain the luster of the dura, its pulsation or bulging often causes doubt.

One needs to consider carefully the questions which direct further operative steps after the resection of the mastoid cells, and, if endocranial signs appear, to direct one's course in line with principles illustrated in the following history of a case which came under my observation. It shows how rapidly an acute otitis may produce an abscess of the brain, and that while the patient may be able to overcome a combined paranasal sinus infection, the same type of infection may become almost fatal even when nature provides proper drainage spontaneously.

REPORT OF CASE

T. H. E., a druggist, aged 32, during June, 1925, suffered a pleural empyema followed by a discharging fistula. On June 2, 1927, he was taken sick with coryza, earache and a frontal headache. On June 9, a special examination revealed a rather narrow left external meatus, and an inflamed, red, swollen, nonbulging drum with an opening in the posterior lower quadrant through which pulsed a

creamy, nonfetid pus. The mastoid was normal in contour, the skin was of normal color and consistence, and no objective pain was noted on pressure.

The patient's right ear had been operated on subsequent to an attack of scarlet fever when he was 3 years of age. Behind the right ear was a cavity the size of a penny leading into a dry, epithelized middle ear. No hearing was possible with this ear. The vestibular functions were not tested.

A conspicuous decrease in the hearing in the left ear was striking, the patient being able to differentiate only loud conversation and concham. Some rise in temperature was present, but had been influenced by the analgesic which he had taken on account of the severe headache.

The nasal cavity showed a pronounced deviation of the septum to the left. Pus drained from both the upper and the middle meatuses, several of the sinuses on both sides apparently being affected, especially the frontal and posterior ethmoids. It was impossible to state how much of the pain could be referred to the sinuses or to the inflamed ear, the poor hearing suggesting a rather serious infection from the beginning. On the following days the patient suffered with severe headache and his ear and nose drained considerably. After a cocaine-epinephrine spray the sinus condition reacted favorably, showing a definite tendency toward healing while the condition of the ear remained the same. The creamy discharge was profuse. A severe headache on the same side of the head, especially toward evening, persisted, the patient being able to secure rest only by taking analgesics. The temperature vacillated from 100 to 102 F.

On June 19, the region of the antrum became somewhat sensitive to pressure, without any noticeable objective changes. On June 21 a roentgen examination was made, resulting in the negative observations previously mentioned. On June 22, the patient vomited once in the afternoon, which prompted me to consider an immediate surgical intervention in spite of the negative x-ray observations. By this time the nasal condition had practically cleared up, and there was only a scant mucous discharge from the left frontal sinus. The patient had an attack of vomiting on an empty stomach the next day, a few hours before operation.

On June 23, a mastoidectomy was performed. It revealed a hyperemic, thick cortex, a pneumatic mastoid process, granulations and pus disseminated throughout the cells. The capsule of the sinus was normal, the zygomatic cells were large, and the wide antrum was filled with granulation tissue and pus. On the top of the mastoid process was found a bony fistula communicating with the middle cranial fossa, no pus being present in the extradural space. The fistula and vomiting suggested endocranial involvement and the probable necessity of a second operation within a few days.

On June 24, the patient had a fairly good day, there were no complaints, the cranial nerves were apparently uninjured and the highest temperature was 102 F.

On June 25, a mild headache was present on the left side. The wound was clean. Pus was present in the antrum, but there was no suppuration from the middle scala or from the middle ear. The fundus of the eye was normal. The hearing was poor, conversational sound being heard ad concham.

On June 26, severe headache was noted. The temperature was 103 F, and the patient was restless and at times drowsy. At 7:30 p. m. the patient's sister observed that he was unable to talk or to move his right hand.

On June 27, paralysis of the right arm and leg was observed. Both sides showed positive Oppenheim and Babinski reflexes, a negative Kernig sign and did not show rigidity of the neck. The pupils were even and sluggish to light. Incomplete amnesic and motor aphasia were present. Cerebration was slow. There was

slight oculomotor and facial paresis. The test for nystagmus was negative there were a few excursions of the eyeballs to the left.

As the antrotomy incision did not yield sufficient space for uncovering the dura around the fistula, a conservative radical operation (in view of the dead right ear) was performed consisting of the resection of the wall of the posterior meatus almost down to the level of the horizontal semicircular canal without breaking through the bridge. The tegmen antri was removed, and an area of the dura 2 cm in diameter, was uncovered. The dura was lusterless with a slight coating of fibrin, through which a crucial incision was made, and the brain was explored in different directions with a needle. About 15 cc of bloody serum was withdrawn, but no pus. This was interpreted as indicating encephalitis hemorrhagica. The cerebrospinal fluid was under moderate pressure, and contained 3 cells per cubic millimeter. The globulin and sugar reactions being negative.

On June 28 the patient felt restless and drowsy. The Kernig sign was positive. Coarse movements of the eyeballs were noted, tests for hearing gave positive results. The dressing was changed and the edges of the dura were found to be retracted, the arachnoid was pinkish and was pulsating. When the brain was touched epileptiform contractions appeared over the body. The left optic fundus was normal, the temporal contour of the right papilla was somewhat hazy. Constipation probably spastic was noted. The pulse rate was 92 and the pulse was regular and strong.

Dr J. Gordon saw the patient and suggested repeated trial punctures of the abscess within a few days.

From June 29 to July 1 the condition remained unchanged. Dressings were made daily.

On July 2, pus was observed oozing from the brain. An incision was made and loose iodoform packing was placed in the abscess cavity.

On the following day considerable pus was present in the brain. The abscess opening was patulous and the abscess walls were well visible and pulsating. The abscess being about the size of a walnut with septums through the cavity. The patient was smiling, observant, answered yes or no and muttered a few unintelligible words.

On July 4, there was considerable brain prolapse, almost filling the wound. The abscess cavity was irrigated with hydrogen peroxide solution. The patient read a newspaper.

On July 5, there was livid granulation tissue in the mastoid wound. The abscess walls were pulsating, and there was scant seropurulent discharge on the drain. The drum was pinkish. Some pus was present in the middle ear. The left papilla was hazy.

From July 6 to 14 gradual improvement was noted. Paralysis diminishing. The patient moved the arms and legs and tried to talk. The wound was granulating and the brain prolapse was retracting.

On July 15 the abscess opening was nearly closed. There was no pus from the brain and the middle ear was dry.

On July 17 the drain in the abscess was discontinued.

On July 18 the patient was apathetic. The temperature was 100.8 F. He complained of headache and vomited once. As retention was suspected the abscess was reopened but no pus was found. The iodoform gauze drain was soaked through in a few minutes with clear serum from the subarachnoid space. Lumbar puncture showed a clear fluid under high pressure with a cell count of 49, traces of globulin, no micro-organisms and a negative sugar reaction. After spinal puncture the patient visibly improved.

On July 19, there was blood from the abscess with appearance of serum later. The neck was free from involvement, the eye movements were normal, tests for hearing gave positive results, and test for nystagmus was negative. The patient tried to talk and understood everything said to him. He seemed to be suffering but said that he did not have headache. The Kernig and the Oppenheim signs were negative. The Babinski sign was positive on the left side.

On July 20, considerable prolapse of the brain was still present. The wound appeared more livid, there was no pus from the abscess, but some blood. The drum was grayish. The patient heard whispering. The right papilla showed signs of papillitis, the left papilla was normal. Methenamine (2.5 Gm.) was given intravenously.

On July 21, no indication of brain pressure was noted. Methenamine (2.5 Gm.) was given intravenously.

On July 22, the brain prolapse was moderate. The wound was granulating. The abscess was closed. Methenamine (2.5 Gm.) was given intravenously.

On July 25, the wound was small. There was slight brain prolapse and good hearing. Methenamine (2.5 Gm.) was given intravenously.

On July 27, the wound was growing smaller and speech was improving. On July 29, no brain prolapse was noted. The wound was granulating. On July 31 the patient sat up for half an hour. On August 4, he was discharged from the hospital.

Recovery was uneventful. On October 1, the patient was free from objective and subjective symptoms, with no sign of the paresis nor of the aphasia.

In this case a temporosphenoid abscess of the brain became manifest on the twenty-fourth day after the onset of a streptococcic otitis media. Whether the organism was *Streptococcus hemolyticus* or another variety of streptococcus was not stated in the different bacteriologic reports.

No doubt the lowered bodily resistance resulting from the pleural empyema and the unfavorable mastoid structure, played important rôles in the development of the endocranial condition. I believe that the fortunate outcome was a result of prompt intervention in line with the principles mentioned in an earlier part of this paper.

DRY NECROSIS OF THE MASTOID

A REPORT OF FOUR CASES *

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AND

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ST LOUIS

The cases here reported represent a peculiar form of mastoiditis characterized by an infection of long duration few symptoms and an extensive dry necrosis. Cultures from cases 1 2 and 4 were negative. In case 3 the laboratory report was: The gram-stained smear shows short streptococci and diphtheroid bacilli, the culture shows gram-negative spored bacilli. It is possible that all of the cases were of *Streptococcus mucosus* origin as this organism may cause extensive involvement of the bone in the mastoid with but few symptoms; further, the tympanic involvement may be transient. In case 1 of this report and in certain other cases reviewed the drum membranes were intact and free from all signs of disease while in the mastoid a most extensive necrosis was present. Prior to encountering these cases, we were unaware that an extensive necrosis of the mastoid could exist for many years with extremely mild symptoms or none and in the presence of a normal tympanum.

In every case of otitis media there is an involvement of the mucosa of the mastoid cells. The reddened and swollen mucosa, the round cell and leukocytic infiltration, the discharge which is too copious to have originated in the tympanum alone form the mastoid pathologic sequence with which we are all familiar. When drainage from all mastoid cells is unobstructed and the usual myringotomy has been performed or when the tube is large and patent it is probable that resolution of the pathologic process in the mastoid occurs without a macroscopic trace of the disease remaining. If for one reason or another the acute process in the tympanum becomes subacute and finally chronic or if the aditus ad antrum becomes obstructed many different conditions can occur in the mastoid.

In otitis media purulenta chronica one usually anticipates a more or less completely sclerosed mastoid with necrosis in varying degrees about the antrum. When the process has existed for a long while and a marginal perforation has developed, through which epidermis from the external canal may wander into the tympanum and thence to the

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mastoid antium, there may gradually occur a progressive bone necrosis from pressure and infection, until at the time of operation one finds a large cavity filled with cholesteatomatous and other material. In still other cases there is an extensive antral necrosis without cholesteatoma but with pus and granulations. The dura of the posterior and middle fossae may be exposed and covered with granulation tissue.

In the cases here reported none of these conditions occurred. There was no evidence of osteoblastic activity, no sign of cholesteatoma except in the tympanum in case 2, and no secretion in any of the three cases.

Primary mastoiditis of blood stream origin doubtless exists but rarely. More commonly the so-called primary mastoiditis, has resulted from a fleeting tympanic infection that has passed into the mastoid cells and become shut in by an obstructed aditus ad antrum. The tympanum fully recovers from infection and presents a normal external wall at an examination months or years later. The inflammatory process in the mastoid may proceed in different ways. If the virulence of the organism is sufficiently great and if the mastoid shell is not sufficiently resistant and the body reacts with a large number of leukocytes and enough fluid, external redness and swelling and perforation of the cortex may occur at an early date. If the bacteria are of low virulence, the exudate not profuse and the mastoid shell strong the pathologic process may go on unnoticed for months or years. The mastoid structures break down the exudate is absorbed the bacteria succumb and finally there results a dry necrosis of the mastoid with the extreme end-result of an empty shell (as in case 1). Probably much of the late necrosis results from lack of blood supply.

C. J. Swan¹ reported the case of a man aged 58 who had had pain in the left ear and the left side of the head for three weeks prior to examination. A mastoid operation had been performed on the right side several years previously, and hearing on that side was normal. Hearing on the left side was markedly impaired. The left drum membrane was red but not bulging. The mastoid was of normal appearance with a slight tenderness to deep pressure. The temperature was 103.6 F. Myringotomy released only one drop of fluid. Three hours after the examination, the patient was comatose, with unequal pupils, slight nystagmus, positive Babinski sign, rigidity of the neck and a moderate discharge from the ear. The spinal fluid was turbid. The mastoid operation revealed the following: There was no thickening of the skin or subcutaneous tissue, the periosteum peeled off easily, the mastoid cortex was livid, the cells were of a bluish lead color (as in case 3) and devoid of mucosa and contained a few granulations.

1 Swan, C. J. Report of Four Cases of Mastoiditis Where Operation Was Too Long Delayed. *Ann Otol Rhin & Laryng* **34** 869 (Sept) 1925.

there was a little pus in the antrum Swan described the condition as "a sort of dry necrotic process never before or since observed by the writer" Type III pneumococcus was recovered from the mastoid and from the spinal fluid The patient died two days later of leptomeningitis Swan concluded "The observations in the mastoid and in the spinal fluid proved conclusively that he died of otitic leptomeningitis and his life could in all probability have been saved by an early operation"

No comment is made on what we believe to be a significant fact namely that the necrosis involving the entire mastoid and reaching the intracranial cavity was not an acute process a process which could plausibly have developed in the three weeks period noted in the history The patient had had a mastoid operation performed on the right side several years previously possibly the mastoiditis of the left side dated from an otitis which accompanied the otitis of the right side at that time

Oscar Wilkinson reported a case of what he called dry necrosis of the mastoid cells

A woman, aged 25 complained of severe headaches and pain behind the eyes, in and behind the right ear and in the occiput In order to eliminate the eyes as a causative factor an error in refraction was first corrected This relieved the pain in the occiput and the frontal headache The pain in the right ear and mastoid continued it became so severe that the patient could not sleep There was nausea and vomiting The drum membrane showed scars and there was a history of repeated suppuration of the middle ear between the ages of 8 and 15, but none for the past ten years The postauricular pain had occurred on several occasions and had lasted from a month to six weeks For twelve months prior to examination, there had been pain and sensitiveness in the mastoid region The temperature ranged from 98.6 to 100 F daily for two weeks before operation The author said "I operated with some degree of hesitancy, owing to the fact that the pain and tenderness on pressure and enlargement of a few superficial lymphatic glands were the only signs of inflammation of the mastoid I expected to find sclerosis of the mastoid tip with an associated neuralgic condition with the possibility of pus in one of the cells On opening the mastoid, the external layer of the bone was found to be more brittle than the normal there was an entire absence of oozing from the bone I found the cells dry and friable apparently as dry as those of a skeleton and much more friable Not a drop of blood was found from the first chiseling of the first layer of bone until the aditus ad antrum was reached There was no pus in any of the cells Recovery was uneventful the symptoms entirely disappearing after the operation"

Here again is a history of previous suppuration with pain and tenderness of the mastoid continuing for years after all evidence of suppuration of the middle ear had disappeared

2 Wilkinson Oscar A Case of Dry Necrosis of the Mastoid, M Rec June 2, 1912 p 1188

Phinzy Calhoun's 400 mastoid operations did not include a case of dry necrosis or a case of mastoiditis with a normal drum membrane. This author emphasized the importance of *Streptococcus capsulatus* in aural infections, he stated that infections from this organism are slow and treacherous. The streptococcus and pneumococcus were responsible for 385 of the 400 cases. This large series is mentioned to show the infrequency of dry necrosis.

Levi Jay Hammond,⁴ in presenting the records of 183 mastoid operations, did not mention a case of dry necrosis.

In E. J. Moure's⁵ tabulation of 500 cases of mastoiditis with operation, mention was made of 1 case of extensive necrosis and facial paralysis, 1 of mastoid necrosis with symptoms of meningitis, 1 of pneumatic mastoid with necrosis of the cortex, 1 of diffuse osteitis with necrosis, 1 with necrosis extending from the outer cortex to the sinus, 1 with a large cavity in the mastoid and necrosis extending to the antrum, and 1 of necrosis involving the labyrinth and presenting an exposed facial nerve with paralysis. Unfortunately, none of the cases of Moure were described in sufficient detail for one to determine whether the necrosis was a dry necrosis or the usual type. However, as the presence of cholesteatomatous material, granulations or pus is mentioned in his other cases, it is possible that these 7 cases were cases of dry necrosis, although the occurrence of so unusual a condition would probably have evoked a lengthy and accurate description.

B. E. Hempstead⁶ reported "six cases of definite mastoiditis in which the middle ear was definitely not affected. In case 1 of his series, a man aged 20, gave a history of ear trouble starting seven years previously. The last attack was five weeks prior to examination. The hearing was normal. Both drum membranes were normal. At operation, a perforation of the tip was found. The aditus ad antrum was very small. An abscess cavity was drained and all cells removed. The culture showed staphylococcus. In case 2, a boy aged 14, had had influenza two months before examination. Hearing was normal. Catheterization of the affected side showed the tympanum to be clear. There was redness and swelling of the tip. Perforation of the cortex, marked destruction of cells and perisinus abscess were found. Cul-

3 Calhoun, Phinzy. Results in 400 Operative Cases of Mastoiditis, New York M. J., Feb. 13, 1909.

4 Hammond, Levi Jay. Case Book Record of 183 Operations on the Mastoid Bone, Philadelphia M. J., Jan. 31, 1903, p. 221.

5 Moure, E. J. Relevé statistique 500 interventions faites sur l'apophyse mastoïde. Communication faite au VII Congrès International d'otologie de Bordeaux, Supplément à la Rev. hebdomadaire de laryngol., August 1904.

6 Hempstead, B. E. Six Cases of Definite Mastoiditis in Which the Middle Ear was Definitely not Affected, Ann. Otol. Rhin. & Laryng. 35:517 (June) 1926.

ture showed streptococcus. In case 3, a man, aged 41, gave a history of influenza four months prior to examination. During the attack of influenza there was pain in the left ear followed by a bloody discharge. At the end of two weeks, there was slight tenderness over the mastoid which disappeared in a few days. The patient was apparently well until two weeks before the examination when he developed a cold followed by tenderness and swelling of the left mastoid. Hearing was normal. The drum membranes were normal. A large subperiosteal abscess and perforation of the cortex were found. All the cells were broken down and filled with pus and granulation tissue. In case 4, a woman, aged 75, came to the clinic with pain and redness over the right mastoid. There was no history of ear trouble until after an attack of influenza the previous winter. The hearing was normal, and both drum membranes were normal. At operation, a subperiosteal abscess was found. The aditus had been completely walled off. The sinus was exposed. Culture showed *Streptococcus mucosus* or type III pneumococcus. In case 5, a man, aged 62, complained of pain in the left mastoid region. About three months previously he had had influenza with bilateral otalgia. Two days after the onset, the right drum membrane ruptured. One week later, the left drum membrane ruptured. The patient was not deaf, there was no perforation of either drum membrane at the time of the examination. The left drum membrane was normal. There was pain and tenderness of the left mastoid. Operation revealed a perforation of the tip. The sinus was exposed. Culture showed type III pneumococcus. In case 6 of the series, a man, aged 21, had pain and swelling in the left mastoid region. Four months previously he had a severe cold with bilateral otalgia. Both membranes had been incised and there was a discharge of pus for four or five days. Three months later, the patient had a slight otalgia of the left side. The hearing and drum membranes were normal at examination. At operation, a large subperiosteal abscess with rupture of the cortex was found. Cell partitions had broken down. Pachymeningitis in the region of Trautman's triangle and a perisinus abscess were found. Culture showed a small gram-negative bacillus.

In his summary, Hempstead stated that in all his cases the structures of the tympanum were normal on physical examination, that the study of the cases of mastoiditis without apparent involvement of the middle ear indicates the existence of an antecedent otitis media, that the roentgen examination is important, that the predominance of *Streptococcus mucosus* in these cases warns us of the danger in this type of infection and puts us on guard when the organism is found in the acutely discharging ear.

Hempstead's cases were not cases of dry necrosis, but are quoted because they seem to represent an early stage of dry necrosis. If the

violence of the invading organism is great and excessive exudation occurs, cortical rupture or intracranial complication may occur and demand operation before the condition can be transformed into one of dry necrosis

Hempstead collected a number of similar cases in the literature which may be briefly mentioned with the names of the original reporters

F H Knight⁷ reported the case of a young girl who, three months after a two weeks' attack of influenza developed a swelling over the mastoid and was operated on the operation revealing extensive destruction of cells

W S Tomlin⁸ had a patient who had been an invalid for ten years prior to examination Because of slight pain back of the ear, the mastoid was opened, and chronic suppurative granulomatous infiltration with thin, dark fluid was found The patient recovered and in a short time gained 20 pounds (9.7 Kg)

T E Hughes⁹ described a case showing pain in the right ear and definite swelling over the mastoid There was a slight discharge for several weeks, and then a gradual "recovery" without operation Eighteen months later the patient developed pain and swelling of the mastoid An operation revealed a definite mastoiditis

J M Brown¹⁰ reported the case of a young woman who in July 1923, went swimming in a plunge, and developed a cold with intense pain in the right ear and a temperature of 101 F Pain continued for one week with no evidence in the drum membrane, of tympanic trouble It lasted until August 6 On September 15 she began to have headaches On October 6 she went to bed with a chill and a temperature of 103 F Blood was discharged through the external canal wall The drum membrane remained normal At operation, the sinus was found exposed and the middle ear sealed off

Arthur M Alden¹¹ in a personal communication reported a case of dry necrosis of the mastoid in a school boy, aged 11, who was seen because of a chronically discharging right ear following measles at the age of 1 year Examination showed a profuse foul smelling discharge which, on smear and culture showed staphylococci and saprophytic organisms There was a large posterior perforation through which

7 Knight, F H Case of Perisinus Abscess Without Involvement of the Middle Ear, *Laryngoscope* **29** 433, 1919, quoted by Hempstead (footnote 6)

8 Tomlin, W S Report of a Case of Suppurative Mastoiditis Without Tympanitis, *Indianapolis M J* **30** 95, 1916, quoted by Hempstead (footnote 6)

9 Hughes, T E An Unusual Case of Mastoiditis Operation and Recovery, *Virginia M Monthly* **49** 726, 1923, quoted by Hempstead (footnote 6)

10 Brown, J M Atypical Mastoiditis Case Report, *Laryngoscope* **34** 644, 1924, quoted by Hempstead (footnote 6)

11 Alden, Arthur M Personal communication to the authors

the lower edge of a large red granulation could be seen. Treatment produced no change in the condition. Roentgenograms showed chronic mastoiditis on this side.

Under gas anesthesia, a typical simple mastoid exposure was made. The cortex covering the mastoid was thick and normal in color. When this was removed, the mastoid cells, which were of the diploetic type throughout, were entirely dry and dark brown, and gave one the impression of dead bone. This bone cut easily with a curet. It was necessary to clean out the mastoid completely before normal bone was reached. The aditus was entirely closed off by a bony growth and was not opened. There was no moisture in the mastoid from which a culture might be taken but a swab rubbed over some of the material removed showed "no growth."

The child made an uneventful convalescence from the operation, but it was necessary to do an ossiculectomy and a partial annulectomy before a result was obtained.

CASE REPORTS

CASE 1—On Feb. 14, 1918, a man walked into our office, accompanied by his son, aged 18. The father looked depressed as if from anxiety of long standing. He volunteered the following information: "Doctor, my son is peculiar and has peculiar things. I'm terribly worried about him." He then told that an appendectomy had been performed on his son one year previously and that shortly after, and in another city, the physicians found it necessary to reopen the abdomen and remove some enlarged glands. Abdominal distress continuing, a third operation was performed and some adhesions were separated. The patient then seemed fairly well up to three weeks before presentation when a mastoid was performed on the right side. The tonsils had been removed on Sept. 1, 1917. There was a history of pneumonia, typhoid fever and pertussis.

The complaint at the time of the examination was pain in both ears, though more in the right ear. Examination revealed a normal right drum membrane, except for a slight injection, and a normal left membrane. The right mastoid showed a scar and marked tenderness on pressure over the antrum, tip and emissary. Slight tenderness existed on pressure over the left mastoid. The whispered voice was not audible in the right ear but was heard in the left at a distance of 40 feet (12 meters). With the noise apparatus on the left, a loud voice was heard with the right ear. Weber test showed lateralization to the left. With Rinne's test, hearing on the right side was not satisfactorily determined. On the left side positive results were obtained, the C¹ fork was heard on the left but not on the right side, and the C⁴ fork was heard normally on the left and not at all on the right side. The mouth was normal. The tonsils had been removed. The oropharynx was normal. There were adenoid vegetations in the epipharynx. The nose showed subacute rhinitis, deviation of the septum to the left and hypertrophy of the posterior end of the left inferior turbinate. The paranasal sinuses were normal.

The condition puzzled us. The markedly reduced hearing on the right side, with the lateralization to the better hearing ear in Weber's test, pointed to nerve deafness. The mastoid tenderness on the right we attributed to the recent operation, that on the left we were entirely unable to understand in view of a

normal drum membrane and hearing at 40 feet. After observation during several visits the opinion was given that the boy was exaggerating the usual discomfort that is felt after any operation. We felt safe in disregarding the slight tenderness on the left side. The father was advised to take the boy home and keep him occupied. To this the father answered "You don't understand my boy. He has peculiar things. I'm sure he has trouble in both his mastoids and I want them opened." We did our best to convince him that as a layman he was not in a position to say when a mastoid was or was not to be operated on. Father and son left the office unimpressed by our words, and the next day they returned. The tenderness was still present. The patient had developed a slight swelling over the left mastoid. Vertical nystagmus upward was noted. The boy was placed in the hospital for observation. The white count was normal, and roentgen examination showed absence of cell outline on the right and left sides. The temperature was 99 F. A general examination by the internist was negative. An exploration of the mastoids was finally decided on.

Under ether anesthesia an incision was made through the scar over the right mastoid. It was promptly discovered that the former "mastoid" operation had consisted of nothing more than a simple incision through the skin and periosteum with the removal of a small amount of bone. The cortex of the mastoid was dark. With a few strokes of the chisel this was removed and under it was revealed an empty shell. The mastoid contained no granulations nor a drop of secretion. The cavity was lined with a grayish-green, dry membrane. The dura of the posterior and middle fossae was exposed in the removal of a thin layer of necrotic bone. The wound was closed in a double layer with catgut, and rubber tube drainage instituted. The drum membrane was not incised. The left mastoid was then exposed. To our astonishment the same discolored bone was found, after removing the cortex another dry, empty mastoid was brought to view. There was no blood except from the skin incision, no pus, and no granulations. The wound was closed as on the right side. Cultures from both sides were negative. Twenty-one days after the operation, both drum membranes were found bulging. A double myringotomy was performed. Thirty-three days after the operation on the mastoid, the right ear was well. Two days later, the left ear was well. The vertical nystagmus disappeared a few days after the operation. Thirty-eight days after the operation, the whispered voice was heard normally on the right side (at 40 feet), and at 15 feet (45 meters) on the left. Soon after, hearing on the left side became normal. Forty days after the operation, the patient was sent home well. Eighteen days later, the patient returned with an acute sinusitis and discharge from the right ear. The next day, a myringotomy had to be performed on the left side. In fifteen days, the ears were dry and soon after, the hearing had again returned to normal.

Several months later, we were greatly surprised to hear that the patient, having developed further trouble with his ears, had consulted a colleague in our city. This physician telephoned our office for information concerning the patient's former trouble, but proffered no information as to the condition at the time. About a year later, the patient died from some undiagnosed abdominal condition.

CASE 2—A woman, aged 23, examined on Feb 10, 1923, complained of a cold which had persisted for six months. In addition to nasal discharge, there was stuffiness of both ears. The previous history showed that the left ear was burned with hot coals in childhood. She had had typhoid fever at the age of 8, measles and whooping cough.

Examination revealed a normal mouth, chronic tonsillitis (pus on the left side), lymphoid tissue in Rosenmueller's fossae and a normal oropharynx, hypopharynx

and larynx. The nose showed deviation of the septum and chronic sinusitis. The right drum membrane was normal, the left showed retraction and a scar. The Rinne test yielded a positive reaction on the right side, and a negative reaction on the left. Weber's test showed lateralization to the left. The C¹ fork was heard on both sides; hearing for the C¹ fork was normal on the right side, but impaired on the left. The whispered voice was heard at 40 feet on the right side, and at 25 feet (7.6 meters) on the left. The patient refused a tonsillectomy and removal of lymphoid tissue from the vault.

On March 10, 1925, the patient returned with an otitis media purulenta acuta on the left side. In three days, the ear was dry. On August 3, she returned with the history of a reinfection of the left ear two weeks previously. There was a large perforation through which protruded a white mass that was apparently cholesteatomatous. A roentgenogram of the mastoids showed blurring and bone destruction on the left side. The temperature was 99.6 F. The C¹ fork was not heard on the left side. Perception of the whispered voice had dropped to 8 feet (2.4 meters) on the left side. There was tenderness over the posterior surface of the tip of the left mastoid. The posterior wall of the left canal was extremely tender to probing. On August 12, the tenderness was more marked on pressure over the tip of the left mastoid.

An operation was performed on August 12. When the outer plate of the mastoid was removed, a mass of dry, gray bone was uncovered. Nowhere was there a sign of cholesteatomatous material, pus or granulations. Large empty cavities were found in the mastoid. The dura of the middle and posterior fossae had to be exposed. A modified radical operation was performed. The posterior wall including the bridge was removed, but the ossicles, drum membrane and membranous external canal were left intact. The wound was closed in two layers with catgut, rubber tube was inserted for drainage. Culture from the mastoid showed no growth. On August 28, the whispered voice was heard on the left at 5 feet (1.5 meters), and on September 14 at 9 feet (2.7 meters). On September 21, it was noted that the perforation was closing and that there was no sign of cholesteatomatous material in the tympanum. On September 26, the whispered voice was heard at 18 feet (5.5 meters) on the left side and on October 23, at 12 feet (3.6 meters), the drum membrane was perfectly healed.

This case is interesting because of the regeneration of the drum membrane, the dry necrosis and the absence of cholesteatoma of the mastoid in the presence of an apparent cholesteatoma of the tympanum.

The apparent cholesteatoma of the tympanum, unrelated to the extensive dry necrosis of the mastoid, is a most unusual observation, for otitis media purulenta chronica commonly shows the following pathologic sequence. Complicating the chronic inflammation of the tympanic mucosa is a similar condition of the lining membrane of the mastoid cells. The round cell infiltration slowly results in the formation of new connective tissue. Ulceration with granulation tissue formation helps to fill the air spaces. Finally the newly formed tissue is invaded by osteoblasts which complete nature's effort at obliteration of a chronically inflamed region. For some unknown reason, the antrum remains a cavity but the aditus may be narrowed or closed. If epidermis wanders in from the canal through a marginal perforation

the process will usually extend into the mastoid and in other directions. As the epidermal growth extends into the antrum it meets the solid sclerotic bone of the mastoid, and after many months or years may undo the work so carefully carried out by nature for the protection of the person, by breaking down the new-formed bone. We are familiar with the theory that the sclerosed mastoid exists prior to the tympanic suppuration. This may occur, but probably the former conditions are of much more frequent occurrence.

In the present case the cholesteatoma was a recent condition, while the extensive dry necrosis had probably existed for many years, possibly dating back to the otitis following the burn which occurred some twenty years previously. This is, of course, mere speculation. It is certain, however, that the mastoid necrosis coexisted with a perfectly intact drum membrane such as was observed five months prior to the operation, for in the interim, and up to two weeks prior to operation, there had been no otitis, the ear was dry and the drum membrane was intact.

When a patient was treated for a chronic condition of the ear, and finally a perfect healing of the drum membrane was accomplished we heretofore took for granted that everything posterior to the membrane was normal. We know differently now. A drum membrane may be intact and free from every evidence of inflammation, the hearing may be good, yet an extensive pathologic condition may be stealthily progressing in the mastoid process.

In a personal communication, Dr. C. Armin Gundelach¹² reported a case of extensive mastoid necrosis in a man whose drum membrane was normal two weeks previously. In this case the condition must have been in existence for at least many months and probably years. Because of the patient's complaints the ear was looked at repeatedly, the drum membrane was found to be normal each time. One day a necrosis of the posterior wall was noted, and soon thereafter a large sequester was removed. A probe could then be passed in all directions from the antrum to the tip. After the sequester had been removed, the drum membrane began to show thickening and slight bulging and had to be incised. The case was not one of syphilis or of tuberculosis. This patient gave the history of several attacks of suppurative otitis media. Doubtless with each attack there had occurred an exacerbation of the mastoiditis and an extension of the necrosis. Finally the process involved the posterior wall sufficiently to break through. Our case 1 is similar to Dr. Gundelach's in that both patients had normal drum membranes and both showed extensive mastoid necrosis. In our case there had occurred a complete breaking down and absorption, whereas in

¹² Gundelach, C. Armin. Personal communication to the authors.

Dr Gundelach's case, the posterior wall was encroached on and necrosis had broken through it before complete absorption could occur

CASE 3—In a boy, aged 3, who was first seen Oct 4, 1921, the complaint was a discharging ear since an attack of scarlet fever at 1 year of age. At times the patient would apparently recover only to have the condition start afresh with each new cold.

Whooping cough occurred at 2 years, followed by a prolonged attack of bronchitis. Recently the patient had suffered greatly from attacks of urticaria.

Examination revealed a chronic tonsillitis with bilateral anterior cervical adenitis, a small adenoid, a normal right drum membrane, a large central perforation of the left drum membrane and a purulent discharge. The whispered voice was heard at 40 feet, on the right side and at 5 feet on the left.

On Oct 5, 1921, a tonsillectomy and an adenoidectomy were performed under gas anesthesia. On October 10, the ear was dry and the patient was discharged.

On Sept 1, 1925, the patient returned. The ear had started to discharge soon after he reached home (Mankato, Minn) and had continued to discharge at intervals since that time. The discharge had become fetid. For several weeks the patient had been unable to whistle. A facial paresis existed. The left drum membrane now showed a marginal perforation.

On Sept 8, 1925, a radical operation was performed on the mastoid. As soon as the periosteum had been elevated, the entire mastoid was seen to be extremely dark. Extensive necrosis was encountered. The dura of the middle and posterior fossae, was exposed. There were large cavities in the necrotic bone, some of them extending alarmingly into the facial spur.

Nowhere was there pus, granulations, cholesteatoma or any sign of moisture, except for the small amount of blood which oozed into the cavity from the skin incision. The bone was dry and brittle. Even the antrum was dry. Sections of bone from the mastoid showed no inflammatory exudate.

A gram-stained smear made with the blood which trickled down from the skin incision showed diphtheroid bacilli and short streptococci. A culture showed gram-negative spored bacilli.

One week after the operation, the facial paresis showed a marked improvement, the patient could again whistle. Finally the condition cleared up completely. Healing took place rather more rapidly than usual, except for the tube which has never closed. On the anterior surface of the facial spur there is also a rather deep and narrow cavity. Several small sequestrars have been thrown off from this cavity.

The marginal perforation and fetid discharge would ordinarily lead one to expect a wet mastoid or at least a wet necrosis of the antrum, with sclerosis of the remainder of the mastoid, if sufficient time had elapsed for such a constructive bone process to have taken place. In this case the fetid discharge originated in the tympanum and tube alone, as the entire mastoid region was dry. That the chronic mastoiditis was a direct extension from the otitis media there is no reason to doubt, but why there should have occurred a dividing of the ways—the mastoid becoming dry and the tympanum continuing wet—we do not know. The aditus ad antrum was not obstructed. At the age of 1 year, when the child developed an otitis from scarlet fever, there

must have occurred a widespread involvement of the mastoid. As is common in scarlet fever, there probably ensued a necrosis of the lining membrane of the mastoid cells. This mucosa failed to regenerate. The denuded bone of the mastoid underwent necrosis and the process became more and more extensive. When the patient was first seen in 1921 and the tonsillectomy and adenoidectomy were performed, the mastoiditis was most probably in existence. Unfortunately, no roentgenogram was made at the time. The fact that five days after the tonsillectomy and adenoidectomy the ear became dry is of extreme interest in view of what was probably transpiring in the mastoid. The urticaria has never recurred since the mastoid exenteration was performed.

The involvement of the orbicularis oris or buccal-supramaxillary nerve presented a most peculiar and unexplained symptom. Just prior to the development of the facial paresis an acute and severe gastrointestinal disturbance occurred, with marked elevation of temperature. The facial involvement was thought to be a toxic neuritis by the physician in charge. On the patient's arrival in St. Louis, we held a consultation with Dr. Harry Lyman. He considered the facial paresis a neuritis resulting from the gastro-intestinal disturbance and not a complication of the condition in the ear. His opinion was based on the fact that only the orbicularis oris was involved. We were inclined to believe that the paresis was a complication of the disease of the ear. We all agreed that the prolonged suppuration, fetid odor, marginal perforation and markedly reduced hearing gave sufficient indication for an operation. The extension of necrosis into the facial spur and the marked improvement in the paresis within a few days after operation, with ultimate complete disappearance of the paresis, left little doubt concerning the chief etiologic factor in connection with the involvement of the seventh nerve. Concerning the selective effect on the buccal-supramaxillary division of the facial nerve, we have no explanation to offer. The neural condition was probably a perineural edema. There is no reason to believe that a central lesion existed.

CASE 4—A woman, aged 23 years, was operated on, on June 14, 1926. She had had purulent otitis media of the right ear in childhood but had recovered without complications. Since then she had had occasional attacks of stuffiness in the right ear, with reduced hearing during the attack. The patient was first seen in August, 1925, while convalescing from an appendectomy. At that time, she complained of a sensation of fulness in the right ear, with mild tinnitus. The drum membrane showed no acute change but a scar and retraction. Inflation gave relief. This was repeated once or twice during the convalescence. Again in January, 1926, the patient complained of discomfort about the right ear, with slight pain around the tip of the mastoid and in the cervical region inferior to the tip. She felt that some pressure existed in the external canal. Examination of the drum membrane disclosed no change from the previous observation. There

was, however, a slight fulness in the posterior superior canal wall, and definite tenderness in that region. No tenderness was noted in the region of the mastoid, and the roentgenogram showed an absence of cell outline and general cloudiness of the mastoid. The patient was kept under observation. There was no improvement in the canal walls. Tinnitus was present only occasionally and was mild. Hearing was normal. The patient was advised that it would be necessary to enter the mastoid surgically because of the probability of a low grade infection. On June 14, 1926, the mastoid was opened. From the antrum to the tip, there was rarefaction and necrosis of the mastoid cells, with all surfaces presenting a glistening white and dry appearance. There was complete absence of moisture in the mastoid. Complete exenteration to normal bone was carried out. A modified radical operation of the Barany type was done, the drum membrane and tympanum were left intact. The postoperative course was uneventful, a culture showed no growth. Two years following the operation, inquiry disclosed that there had been no further trouble with the ear.

SUMMARY

Dry necrosis of the mastoid is a condition of infrequent occurrence. It is the end-result of a mastoiditis of long duration and low virulence. The tympanum may be found normal or may show a chronic suppuration. Judging from what is known of the habits of the type III pneumococcus or *Streptococcus mucosus*,¹³ it may be that dry necrosis represents the typical end-result of this type of mastoid infection.

Just why this rare condition of the mastoid should ever supervene is interesting material for speculation. Is it as follows? A fleeting

13 It is commonly accepted that type III pneumococcus is identical with *Streptococcus mucosus*. The following personal communication to the authors from O. T. Avery of the Rockefeller Institute, however, gives a different view which must be kept in mind in carrying out bacteriologic studies of suppurative otitis.

"The earlier work of Park and Williams (1905) and the subsequent studies of other investigators show that the organism formerly classed as *Streptococcus mucosus*, should be placed with the pneumococcus, under the common name of *Pneumococcus mucosus*, since it has many characteristics in common with the pneumococcus group. Considerable confusion has existed in bacteriological literature, regarding the identity of the so-called *Pneumococcus mucosus* and *Streptococcus mucosus*. *Pneumococcus mucosus* or type 3 pneumococcus possesses characteristics typical of pneumococcus and is bile-soluble, ferments inulin, possesses a capsule, is virulent for mice, produces a greenish decoloration on blood media, and reacts specifically with antipneumococcus serum type III. Occasionally strains are encountered which, although having a similar mucoid heaped-up confluent colony and possessing a capsule, are, however, not bile-soluble, do not ferment inulin, are not so pathogenic for mice, and have a greater tendency to produce hemolysis on blood agar. These strains conform to the *Streptococcus mucosus*, and like other streptococci do not react specifically with anti-pneumococcus serum type III.

"The *Pneumococcus mucosus* is more commonly encountered in disease processes, and occurs in about 10 to 15 per cent of cases of pneumococcus pneumonia. It has also been found in other diseases such as mastoiditis, meningitis, peritonitis, etc."

Pneumococcus mucosus infection of the tympanum passes into the mastoid cells. The aditus becomes obstructed. Involvement of the mucosa is soon followed by osteitis. The surrounding shell is strong enough to resist invasion. There is a limited amount of exudate, insufficient in most cases to cause symptoms of pressure. As the partitions of the mastoid cells break down, the blood supply is cut off. Slowly the exudate is absorbed by the surrounding shell which retains its circulation, and the invading organism perishes. Finally, the disintegrated cell walls become a mass of dry bluish-black bone remnants which may become entirely absorbed as in case 1, leaving an empty mastoid shell.

CONCLUSIONS

Cultures should be obtained in every case of acute suppurative otitis in order to enable the otologist to predict the possibility of the pathologic sequence described. If type III pneumococcus or *Streptococcus mucosus* is found, the patient should not be discharged as cured when the drum membrane and hearing have returned to normal but should be kept under observation for many months. Finally roentgenograms should be made to determine whether or not the mastoid is normal.

1000 Carleton Building

THE INOPERABLE TONSIL

TREATMENT WITH RADIUM IN PREFERENCE TO OTHER NON- OPERATIVE METHODS *

J COLEMAN SCAL, M D

NEW YORK

After considerable observation of the use of nonoperative methods in the treatment of diseased tonsils, which for one reason or another cannot be removed surgically, I still prefer radium to all other measures. With the improved technic in the preparation and the application of the radon seeds, disease of the tonsils can be eliminated in from one to three months.

Removable platinum seeds (radon seeds), each about 4 mm long, are my choice. They have a screenage of 0.33 mm thickness of platinum, which practically eliminates 98.5 per cent of the caustic beta rays. Each radon seed contains about 2.56 millicuries of radium emanation, but can be made to contain more or less emanation, as required. After the seed has been in situ for five or six days, it is removed by means of a silk thread attached to one end of the seed. At the end of this time, the maximal activity of the radon is spent, as the radon decays at the rate of 0.747 per cent of its activity each succeeding hour. The maximal dosage for each millicurie of emanation is 133 millicurie hours, the highest amount of radiation is therefore obtained during the first five or six days. This amount is sufficient to affect the lymphoid tissue of the tonsil so as practically to eliminate it without injuring any adjacent structures.

In those cases in which the tonsils were fibroid because of repeated attacks of peritonsillitis, the end-results were far from satisfactory. The fibroid tonsil was not visibly affected by this method, though in each case the patient admitted improvement and often freedom from further attacks of tonsillitis.

The method of application is important. Several colleagues who have tried this method of treatment without success attribute the failure to the fact that the seed fell out and to the resulting insufficient radiation. In watching their technic, I found that the seed was not embedded deeply enough and that the muscular action of the palate and pillars in swallowing therefore tended to dislodge it. The seed should be planted centrally into the tonsil, so that the end of the seed is at least 2 mm below the surface. This will assure an equal amount of radiation to the entire

* Submitted for publication, Oct. 23, 1929.

* From the Oto-Laryngological Service, Beth Israel Hospital.

tonsil Recently I changed my technic Whereas I previously used one seed containing an average dose of about 3 millicuries of radon for each tonsil, I now use two seeds for each tonsil, each seed containing 1.5 millicurie The tonsil is divided by an imaginary line and one seed is implanted in the center of each half By this means, a better and more complete radiation is obtained and the end-result is far more satisfactory

The advantages of this treatment are that no anesthetic is required,



Fig 1—*A*, before treatment with radium, *B*, four months after treatment with radium



Fig 2—*A*, before treatment with radium, *B*, one year after treatment with radium

confinement to the hospital is unnecessary, and there is practically no disability Only one treatment is necessary There is seldom any reaction

In studying the recent methods of eliminating the tonsils the radical operation of tonsillectomy was found to be the most efficient The ideal method is the complete enucleation of the tonsil without damage to the pillars or to the adjacent structures Even if such a procedure is followed and immediately after operation the pillars are found to be intact

and the faucial arch symmetrical, examination of the throat several months later will show a different picture. This is due to the granulations covering the exposed muscles with the consequent cicatricial contraction of the pillars and arches.

The electrocoagulation method of eliminating the tonsils is the application of the high frequency current from a properly regulated machine. This procedure can be carried out only by skilful hands, otherwise, considerable damage and destruction will be produced. It is extremely

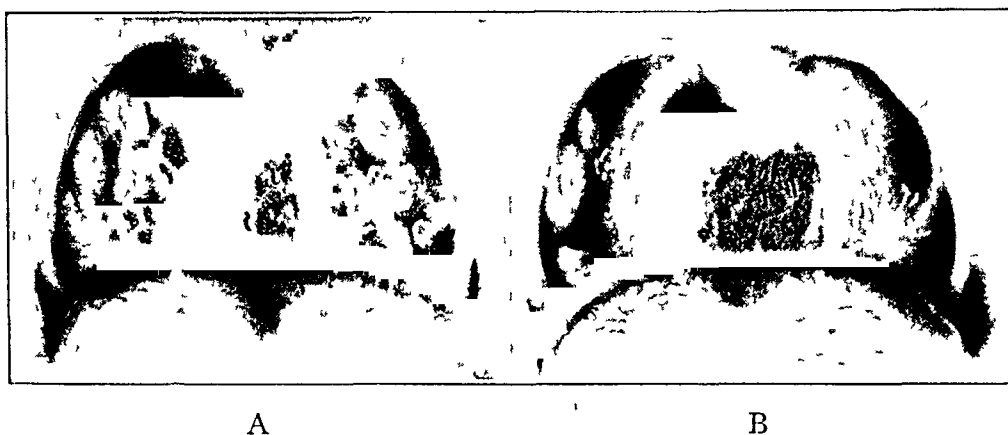


Fig 3—*A*, before treatment with radium, *B*, six months after treatment with radium

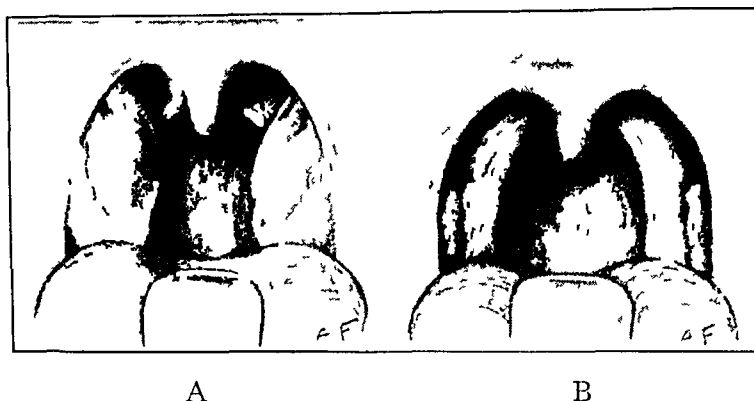


Fig 4—*A*, before treatment with radium, *B*, six months after treatment with radium

difficult to treat submerged and adherent tonsils by this method without damaging adjacent structures.

The roentgen method of treatment which was advocated and recommended by Witherbee has fallen into disrepute and is not being used now. This method consisted in giving a course of roentgen treatment to the neck in the attempt to atrophy the tonsils. The result, while having a slight effect on the tonsils, also acted on the adjacent lymph glands, and dry mouth resulted. The tonsil itself was never affected enough to eliminate the focal infective condition.

SUMMARY

The treatment of inoperable tonsils with the implantation of removable platinum radon seeds is an adequate substitute for tonsillectomy in those cases in which surgery is contraindicated

Only one treatment is necessary. There is no hospitalization and no anesthetic, and the patient has no pain or discomfort in attending to his usual occupation.

As compared with the roentgen treatment, the radium exerts its action only on the lymphoid tissues in the area implanted, without affecting the adjacent tissues. The roentgen rays affect all the tissues and result in annoying after-effects. Electrocoagulation likewise can be used only by skilled hands, even then there is the possibility of damaging the adjacent structures.

44 West Seventy-Fourth Street

SURVEY OF THE HEARING OF THE SCHOOL CHILDREN OF SAN FRANCISCO ⁴

FRANK H. RODIN, M.D.

SAN FRANCISCO

The following is the first report showing a systematic survey of the hearing of all the school children of a large city, from 9 to 16 years of age.

The introduction of the phonograph audiometer ¹ (Western Electric No. 4-A) made possible the testing of the hearing of a large number of persons at one time. This instrument is now used in many cities for the examination of school children.

The phonograph audiometer (fig. 1) is an instrument consisting of a phonograph and records through which speech vibrations, consisting of numbers, are conducted to telephone receivers attached to the hearers' ears. Forty persons can be tested at one time. Figure 2 shows an arrangement of such a group. Blank forms (fig. 3) are distributed to the children on which they write the numbers as they hear them. The loudness of the consecutive numbers is decreased in uniform steps, and by comparing the recorded observations of the children with a master sheet, the hearing rating of each child is readily determined. The phonograph audiometer is calibrated in sensation units,² which is the unit adopted by Harvey Fletcher.

METHOD OF EXAMINATION

The examination at San Francisco was carried out as follows. The board of health in cooperation with the board of education and the parochial schools undertook a systematic survey of the hearing of all school children from grade 4 through junior high school. This included the children from the ages of 9 to 16 years. Grade 4 was chosen as a starting point because children at that age are old enough to cooperate with the examiner. It took two years to complete this survey.

* Submitted for publication, Sept. 6, 1929.

* From the Division of School Health Inspection, Department of Public Health, William C. Hassler, M.D., Health Officer.

1. Fowler, E. P., and Fletcher, Harvey. Three Million Deafened School Children, J. A. M. A. **87** 1877 (Dec. 4) 1926.

2. To convert from loss of hearing in sensation units to percentage of hearing loss for speech multiply by 0.83. See Fletcher, Harvey. New Methods and Apparatus for Testing the Acuity of Hearing. Laryngoscope **35** 501 (July) 1925.

A technician, supplied by the board of education, using the phonograph audiometer, tested the children³ Those who had a loss of 9 or more sensation units in one or both ears were retested The children who on the 1st test showed a loss of 9 or more sensation units in one or both ears were examined by the otologist of the board of health He also examined children from the lower grades who according to the teachers had some hearing defects The examination was conducted at

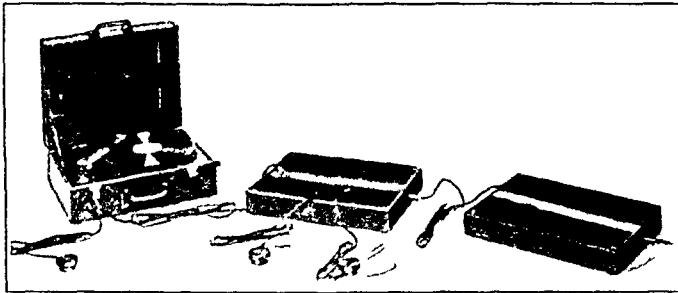


Fig 1—The phonograph audiometer



Fig 2—Testing of children

school A brief history of any ear complaint was obtained The ears were examined with an electric otoscope, and an inspection of the mouth was made The otologist made such other tests as he thought necessary for the proper diagnosis of the child's hearing condition, and his observations were recorded on the back of the blank form used by the child (fig 4)

³ Van Deveer, B The Hearing Survey of the San Francisco Public Schools, *Volta Rev* 30 761 (Nov) 1928

The otologist examined the children with the following objects in view first, to discover, if possible, the cause or causes producing the loss of hearing which may need medical attention, second, to find the children who had such an impairment of hearing that they were in need of instruction in lip reading. With the first type of children the parents were notified by a card (figs 5 and 6) calling attention to their child's loss of hearing and to any correctable defect that may have been found by the examiner. On this card the loss of hearing in sensation units was converted into percentage of loss of hearing, so that it might be understood by the parents. The names of the children who were in

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DEPARTMENT OF PUBLIC HEALTH, SAN FRANCISCO CALIF
DIVISION SCHOOL HEALTH INSPECTION HEARING TEST REPORT

NAME _____ AGE _____
SCHOOL _____ GRADE _____ DATE _____ 19__

HEARING LOSS	RIGHT EAR				LEFT EAR				HEARING LOSS
	1	2	3	4	5	6	7	8	
30									30
27									27
24									24
21									21
18									18
15									15
12									12
9									9
6									6
3									3
0									0
-3									-3

Any history of ear trouble?

Fig 3—Blank form for use by child

need of instruction in lip reading were given to the board of education (figs 7 and 8). It is the aim of the board of health to test all the children every three years.

RESULT OF SURVEY

There were 118 schools examined consisting of 18,283 boys and 17,908 girls, a total of 36,191 children. On the first test 6,592 children had a loss of 9 or more sensation units in one or both ears, or 17.7 per cent. On the retest, 3,427 children had a loss of 9 or more sensation units in one or both ears, or 9.5 per cent. This is 52 per cent of the children who had a loss of hearing in the first test. The percentage of children who had a loss of 9 or more sensation units in one ear, the other ear having normal hearing, was 6.5 while 3 per cent had a loss

of 9 or more sensation units in both ears. The percentage of children who had a loss of 30 or more sensation units in one ear, the other ear having normal hearing, was 1.1, while 0.2 per cent had a loss of 30 or more sensation units in both ears.

The number of children referred for instruction in lip reading was 441 in their own schools (hard of hearing children), 207 boys and 178 girls, a total of 385, in special classes (deafened children), 30 boys and

Date..... 19	
Complaint	
.....	
.....	
RIGHT	LEFT
Whisper	
Watch	
Weber	
Rinne.....	
Schwabach	
C 1.....	
C 4.....	
Phono-Audiometer	
Audiometer A 2	
Ear Drums.....	
.....	
.....	
Throat Examination	
Whispered Conversation	
Comment	
.....	
Recommendations	Lip Reading Class
	Card
	Retest
	None

Fig 4—Blank form for the use of otologist. C—1 = 64 double vibrations
C—4 = 2,048 double vibrations

22 girls, a total of 52, in the school for the deaf, 2 boys and 2 girls. The percentage of children needing training in lip reading was 1.2, or 12.8 of those having a loss of 9 or more sensation units in one or both ears.

CORRECTABLE DEFECTS

There were 3,478 children examined by the otologist, and 1,073 notification cards were sent to the parents. The following correctable defects were found (table 2): large and infected tonsils, 355, dis-

charging ears, 185, impacted cerumen in one ear, 180, impacted cerumen in both ears, 114, and nose troubles, 19 The total number of defects was 853 To this list of defects should be added drums with marked retraction, large dry perforations and granulations, which, if treated, may result in improvement in hearing

TABLE 1—*Summary of the Hearing Survey of the School Children of San Francisco*

		Number of Children	Per Cent of Total Number of Children Tested	Per Cent of Children Who on Retest Had a Loss of Nine or More Sensation Units in One or Both Ears
Number of children tested				
Boys	18,283			
Girls	17,908	36,191		
Number of children who on first test had a loss of nine or more sensation units in one or both ears				
Boys	3,424			
Girls	3,168	6,592	17.7	
Number of children who on retest had a loss of nine or more sensation units in one or both ears				
Boys	1,859			
Girls	1,568	3,427	9.5	
Number of children who on retest had a loss of nine or more sensation units in one ear, the other ear having normal hearing		2,348	6.5	68.5
Number of children who on retest had a loss of nine or more sensation units in both ears		1,079	3	31.5
Number of children who on retest had a loss of thirty or more sensation units in one ear, the other ear having normal hearing		382	1.1	11
Number of children who on retest had a loss of thirty or more sensation units in both ears		65	0.2	1.9
Number of children recommended for instruction in lip reading				
Hard of hearing children (in their own school)				
Boys	207			
Girls	178	385		
Deafened children (in special classes)				
Boys	30			
Girls	22	52		
Deaf children				
Boys	2			
Girls	2	4	44.1	12.8
Number of children who on retest had a loss of nine or more sensation units in one or both ears and who had an operation on the mastoid, five of them had operations on both mastoids		98		2.9

RESULTS OBTAINED FROM THE NOTIFICATION CARDS
SENT TO THE PARENTS

There were 1,073 cards sent to the parents notifying them about their child's ear condition (table 3) These cards were followed up by visits from the school nurses to the home of the child if it was necessary, with the following results 490, or 46 per cent of the children, received medical attention, while in 241 cases, or 22 per cent, the parents promised to have medical attention given Fifty-nine parents, or 6 per cent, refused to have any medical attention given, 116, or 11 per cent, refused to cooperate with the nurses, and 167 or 15 per cent, could not be found at home

It is unnecessary to discuss fully the relation of the defects found to the loss of hearing. The close relation of hypertrophied and infected tonsils to impaired hearing is well known to all otologists. Discharging ears under proper treatment can often be cured with resulting improvement in hearing or with the prevention of further loss of hearing. The majority of the children with discharging ears had had little or no medical attention and were not under medical care when examined. Some of the children with impacted cerumen gave a history of impaired hearing of long standing of the affected ear.

TABLE 2—*Defects Found*

Number of children examined by the otologist		3 478
Number of notification cards sent to the parents		1,073
Defects	Large and infected tonsils	355
	Discharging ears	185
	Cerumen in one ear	180
	Cerumen in both ears	114 294
	Nose troubles	19
Total number of defects found		853

TABLE 3—*Results Obtained from the Notification Cards Sent to the Parents*

	Number	Per Cent
Children who received medical attention	490	46
Children whose parents promised medical attention	241	22
Children whose parents opposed medical attention	59	6
Children whose parents refused to cooperate	116	11
Children whose parents could not be found at home	167	15
Total number of notification cards sent to the parents	1,073	100

HARD OF HEARING, DEAFENED AND DEAF CHILD

For educational purposes it is best to differentiate between the hard of hearing, the deafened and the deaf child. A deaf child is one who either was born deaf or acquired deafness early in life, usually before the sixth year, and whose loss of hearing in the better ear is about 50 sensation units or more. Usually these children have no speech. A hard of hearing child is one who has some impairment of hearing—enough to interfere with his education—which later may act as a handicap in his ability to earn a living. These children usually have a loss of hearing of 15 sensation units and no more than 25 in the better ear. In this group are usually included children who have normal hearing in one ear and a loss of 30 or more sensation units in the other. The deafened child is one between the group of the hard of hearing children and the group of the deaf children, and one who has speech. To this group belong children with a loss of 25 and no more than 50 sensation units in the better ear.

The term deaf child applied to one who has a moderate loss of hearing is an unfortunate one the word "deaf" unduly alarms the parents and the child These children are not deaf they are hard of hearing, and should be called hard of hearing children A child that has a marked loss of hearing and has speech is usually not a deaf child but a deafened child

DEPARTMENT OF PUBLIC HEALTH SAN FRANCISCO CALIFORNIA DIVISION OF HEALTH INSPECTION HEARING CONSERVATION	
Your child	attending
grade	at School,
was found by PHONOGRAPH AUDIOMETER test to have a hearing loss of	
per cent on the right ear and	per cent on the left ear
The child also has	
Kindly have the child examined by an ear specialist and return this card to SCHOOL NURSE	
Date	19 (over) Health Officer

Fig 5—Notification card sent to the parents

RECORD OF PHYSICIAN'S EXAMINATION (To be filled out by physician)	
Condition found	-
Treatment recommended	-
Is condition progressive stationary or will it improve under treatment?	
Remarks	-
Date	19 Examiner M D
(over)	

Fig 6—Record of physician's examination to be written on the reverse side of the notification card

IMPAIRMENT OF HEARING NECESSITATING INSTRUCTION IN LIP READING

It is not always easy to decide just how much loss of hearing incapacitates a child so that instruction in lip reading is necessary Children cannot be standardized as adults Children will vary one child with normal hearing in one ear and a total loss of hearing in the other ear will have no difficulty in following a whispered conversation and may even be unaware of the fact that he has one deaf ear, another child with normal hearing in one ear and a moderate loss of hearing in the other

child whose retardation is greater than the average retardation of normal hearing children should be placed in the class for lip reading training”⁴

The hard of hearing children receive instruction in lip reading in their own schools. A special teacher of lip reading visits the schools and instructs these children, giving two half-hour periods a week. When there is a teacher in the school qualified to give such instruction, this is done by her. For deafened children a room is set aside in an ordinary school building, where they receive intensive training in lip reading under a specially trained teacher. These children take some of their lessons in the ordinary classrooms, but most of their work is done in the special room with the teacher of lip reading. “To educate deafened children with deaf children will ultimately distort the speech of the deafened children”⁵. The deaf child is educated in a special school for the deaf.

TABLE 4—*Nationalities of Children Attending the School for the Deaf*

American (white)	29
Italian	6
Irish	2
Greek	1
German	1
Scotch	1
Austrian	1
Hungarian	1
Roumanian	1

ORAL DAY SCHOOL FOR THE DEAF

The children attending the school for the deaf were tested individually with a tone range audiometer (Western Electric No. 2 A).

There were forty-three children attending the school for the deaf. There were twenty-four children with congenital deafness: twelve boys and twelve girls, and nineteen with acquired deafness: ten boys and nine girls.

In studying the nationalities of these children, only those children were classified as foreign who were born in a foreign country or whose parents were both born in a foreign country. All other children were classified as American (table 4). There were twenty-nine American (white) children, six Italian, two Irish, and one each of Greek, Scotch, Austrian, Hungarian and Roumanian descent. In one of the cases in which the children were classified as American, the mother was American and the father was Russian, in one the mother was American and the father was Scotch, and in one the father was American and the

⁴ The Deafened School Child, Report of the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association, 1928, p. 33.

⁵ Footnote 4, p. 31.

mother was a native of the Philippine Islands. In the case of the German nationality, the father was German and the mother was born in Peru. In that of the Roumanian nationality, the father was Roumanian and the mother was Bulgarian, while the child was born in Constantinople.

The etiology of the children with acquired deafness was as follows (table 5): meningitis, six; infantile paralysis, three; two showed evidence of paralysis of the lower limbs; injury, two, one with a history of a fall when 5 years of age and another with a history of a fall when 9 months old; whooping cough, two, in one case the parents were first cousins; suppurative otitis media with abscesses of the ears when 1½ years of age, one; suppurative otitis media, with bilateral mastoiditis and operations, one; influenza, one; diphtheria, one; measles, one, and

TABLE 5—*Etiology of Acquired Deafness of Children Attending the School for the Deaf*

Cause	Number	Comment
Meningitis	6	
Infantile paralysis	3	Two show evidence of paralysis of the lower limbs
Injury	2	One had a fall when 5 years of age; one had a fall when 9 months old
Whooping cough	2	Parents of one child are first cousins
Suppurative otitis media	1	Abscesses of the ears when 1½ years old
Suppurative otitis media with bilateral mastoiditis and operations	1	
Influenza	1	
Diphtheria	1	
Measles	1	
Syphilis (?)	1	
Total	19	

syphilis (?), one. It will be noticed that meningitis and infantile paralysis were responsible for almost half of the cases.

Of the twenty-four children with congenital deafness, twenty-three were tested with the audiometer and one was too young to test. Of these, fifteen, or 65.2 per cent, had a loss of between 48 and 75 sensation units in the better ear, and eight, or 34.8 per cent, had a loss of between 76 and 120 sensation units.

Of the nineteen children with acquired deafness, sixteen were tested, and three were too young to test. Six, or 35 per cent, had a loss of between 42 and 75 sensation units in the better ear, and ten, or 62.5 per cent, had a loss of between 76 and 120 sensation units.

COMMENT

One of the most serious handicaps to any child is an impairment of hearing. Even a moderate degree of deafness is often an obstacle in the education of the young. One of the chief causes of retardation and inattention in class work is difficulty in hearing. A diminution in the

acuity of hearing in early life, if not corrected, often progresses to a marked loss of hearing later in life

This survey made at San Francisco shows the value of a survey of the sense of hearing and the ease with which school children may be examined. No other method could have made possible such a systematic examination of 36,191 children in such a short period with one technician and an otologist as that using the phonograph audiometer.

It is interesting to note that of the 36,191 children tested, 50.5 per cent were boys and 49.5 per cent were girls. On the retest, of the 3,427 children who had a loss of nine or more sensation units in one or both ears, 54 per cent were boys and 46 per cent were girls. Of the 441 children referred for instruction in lip reading, 54 per cent were boys and 46 per cent were girls. Just why there should be a larger number of boys than girls who have a loss of hearing and who are in need of training in lip reading I do not know. There were 98 children who on retest had a loss of nine or more sensation units in one or both ears and who had an operation on the mastoid, five of them had operations on both mastoids. This is 2.9 per cent of the children who had a loss of hearing.

There is a definite relation between defective hearing and disorders of speech. According to Glassburg.⁶

The ears should be examined in every case of defective phonation associated with any degree of diminished hearing, for the speech defect may be due to the inability of the child to hear the finer shadings of his own voice. The relation of the auditory sense to speech is well illustrated by the deaf, who possess a monotonous colorless speech. It is a well known fact that children who cannot hear will not of their own accord learn to speak. The deafness may be due to a congenital defect in the structure of the ear or to adenoids, hypertrophied tonsils, abscesses and obstructions of the air passages. Removal of the obstruction will often improve the hearing and through it the speech.

The finding of 1.2 per cent of the children between the ages of 9 and 16 with a sufficient impairment of hearing to necessitate training in lip reading justifies the systematic and periodic examination of all school children to locate defects that if uncorrected, may eventually lead to permanent loss of hearing.

The value of such a survey is well summarized in the "Deafened School Child."⁷

1 There are approximately 3,000,000 children in the United States having definitely measurable hearing defects.

2 These hearing defects are a serious handicap to a majority of the children.

6 Glassburg, J. A. Is the Treatment of Speech Disorders a Medical Problem? J. A. M. A. **92** 960 (March 23) 1929.

7 Footnote 4, pp. 11 and 12.

3 A large percentage of them repeat grades many times, costing the communities important sums for this reeducation

4 The difficulty of securing education is likely to discourage the child and cause him to abandon his effort

5 It is impossible to predict the future progress of a hearing defect and in consequence all must receive medical treatment, and special educational provisions must be made for many

SUMMARY

1 With the use of the phonograph audiometer, a hearing survey of the school children of San Francisco was made

2 One hundred and eighteen schools were tested consisting of 36,191 children

3 On the first test, 6,592 children were found to have a loss of nine or more sensation units in one or both ears

4 On 1st test, 3,427 children were found to have a loss of nine or more sensation units in one or both ears, or 9.5 per cent

5 Four hundred forty-one children, or 1.2 per cent were referred for instruction in lip reading

6 One thousand and seventy-three notification cards were sent to the parents

7 Forty-three children attending the school for the deaf were examined. Twenty-four children had congenital deafness and nineteen had acquired deafness

8 A survey of the hearing of school children a suitable audiometer being used, should be carried out every two or three years

490 Post Street

IODIZED OIL AS AN AID IN THE DIAGNOSIS OF CHRONIC MAXILLARY SINUS DISEASE *

E LLOYD JONES, M D

WHEELING, W VA

In the diagnosis of chronic maxillary sinus disease the most reliable means of investigation are lavage and roentgenographic examination. It happens not infrequently that lavage is negative, and that the roentgenogram shows bilateral moderate clouding of such nature that it is interpreted by the roentgenologist as negative for sinus disease. To subject these patients to exploratory operation through the canine fossa or to allow them to go without further study constitutes failure to take advantage of recent researches in the study of the sinuses. If it is feasible to make injections of a contrast medium into a sinus and thus outline the contents of the sinus which are not revealed by irrigation, it must be conceded that this procedure approaches, in information obtained, actual exploration of that cavity.

The use of radiopaque substances in the study of the sinuses is becoming more prevalent, fortunately, as is evidenced by the increase in the number of articles published relative to this subject. In 1926, Fraser¹ was the first to publish his observations on the use of iodized poppy seed oil 40 per cent in the investigation of the maxillary sinuses. His latest paper is most comprehensive.² The method is now beyond the experimental stage. However, it is only after a large mass of evidence has been gathered and sufficient experiences interchanged that one can hope to rely on the observations with as much assurance as the roentgenologist does in filling defects of the stomach.

It is my purpose in this paper to describe the methods used and to present a varied array of conditions in which the oil has helped in making a more accurate diagnosis.

* Submitted for publication, Aug. 30, 1929.

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Read before the Section on Laryngology, Otology and Rhinology at the Eightieth Annual Session of the American Medical Association, Portland, Ore., July 11, 1929.

1 Fraser, R. H. Iodized Oil in Otolaryngologic Diagnosis, Opaque Injection Study of Thirty-Five Maxillary Sinuses, *J. Michigan M. Soc.* **25**: 270 (June) 1926.

2 Fraser, R. H. Diagnostic Uses of Lipiodol, *Radiology* **12**: 6 (Jan.) 1929.

METHOD

After preliminary study and routine roentgenography, the antrum is punctured beneath the inferior turbinate with a small trocar. In the large majority of cases irrigation is then instituted with physiologic solution of sodium chloride, but in some, when it is felt that no pus exists, the irrigations are omitted. In no case was any appreciable change in the filling defect found to be due to the irrigating fluid itself. After irrigation, iodized sesame oil 40 per cent is injected at room temperature until the oil drips from the nose, the head being inclined slightly forward. The trocar is then withdrawn and the roentgenogram is taken within the next ten or fifteen minutes. No pack is placed in the nose. Owing to the high viscosity of the oil, a sufficient quantity does not escape during the time required to expose the film to alter the results.

The sinus must be filled completely, as indicated by seeing the oil drip from the nose with the head inclined slightly forward. Several incomplete fillings were recorded because the appearance of the oil was not awaited. Repetition of the study verified this opinion. If the head is held so that the floor of the nose is in a horizontal position, the overflow will often run posteriorly and enter the lung. This occurred in one instance of sinusitis associated with bronchiectasis to such a degree that an injection of poppy seed oil into the lungs was unnecessary to verify the diagnosis of bronchiectasis.

Injection of the oil beneath the mucosa of the naso-antral wall is possible. This is more apt to occur when the straight needle rather than the curved trocar is used. Oil beneath the mucosa will do no harm and will eventually become absorbed. During all procedure, sterile technic should be employed throughout. Although no bacteriologic studies have been made, there is no indication that iodine 40 per cent in oil will sterilize either the oil or the cavity in which it lies.

Roentgenograms are made with the patient in the Waters position (mouth widely opened, the chin and nose touching the cassette). When indicated, a second exposure is made with the patient in the lateral-prone position. The Potter-Bucky diaphragm is employed whenever possible. It should be noted that in most cases one exposure before and one after the injection are all that is required. Therefore, the cost and time involved are not prohibitive to the use of this method in the routine study of sinus disease.

Every rhinologist should be able to interpret the roentgenogram and should not hesitate to question the roentgenologist's primary report if he has reason to believe from his own examination that sinus disease is present. Cooperation between the roentgenologist and the rhinologist in studying disease of the sinuses in this manner will help both materially.

The sinuses are allowed to empty themselves. The patients are warned to expectorate the oil as it drips into the pharynx. The emptying time itself was not made a subject of direct investigation for various obvious reasons. However, a sufficient number of cases was observed to indicate that the normal sinus empties itself in from twenty-four to forty-eight hours.

RESULTS

The size, shape and capacity of an antrum can be determined accurately by the method described. The capacity is ascertained by the amount of oil required to fill the sinus. The average normal antrum is filled by from 7 to 12 cc of the oil. An abnormally small nonpathologic antrum holds from 3 to 6 cc of oil whereas the pathologic one

may take from 1 to 5 cc or more, depending on the size and nature of the contents of the antrum

As previously stated, the emptying time of the normal sinus is less than forty-eight hours. Any appreciable delay can be considered as indicating some pathologic interference with the drainage mechanism. The longest interval during which oil was known to have remained in the sinus was three months.



Fig 1—*A*, uninjected antrums—normal, *B*, same as *A*, after injection—negative, *C*, injected left antrum—septate, negative, *D*, small but normal antrum

Roentgen examination following the injection of the oil will show whether the membrane is thickened, smooth or polypoid. When the study is repeated at intervals, any decided change in the thickness of the mucous membrane can be observed. Rapid changes do occur in the catarrhal types of sinusitis, and before beginning any radical surgical procedure it would not be amiss to repeat the injection after one or more irrigations. Often the membrane will be found to be within the normal

limit of thickness of 1 mm. It is in this class of nonsuppurative cases that the oil has its greatest use, and it is in this type of disease that much further study should be made as to diagnosis and treatment.

The diagnosis of polyp or granulation masses, especially when located in the lower part of the antrum, is often missed without the aid of opaque injection. In this type of sinus disease there are frequently

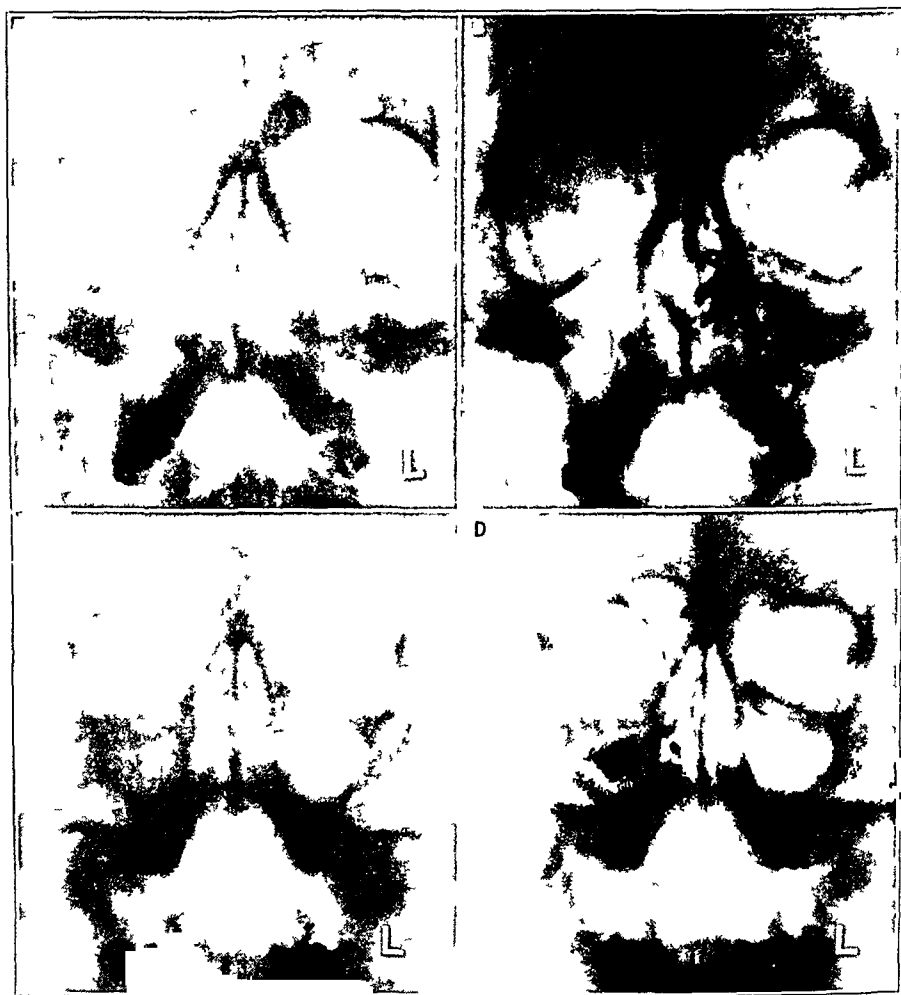


Fig 2—*A* and *B*, both antrums transilluminated clearly, left diffusely opaque in primary film. Irrigation produced 3 cc of pus. Note the decided filling defect. *C* and *D*, bilateral suppurative otitis media, no nasal symptoms, right antrum slightly clouded on transillumination. Three and one-half cubic centimeters of pus was obtained on irrigation. Typical of defect obtained in chronic suppurative maxillary sinusitis.

no symptoms attributable to the sinus. Usually transillumination and irrigation reveal no positive observations and roentgenograms taken without injection reveal indefinite changes. A definite diagnosis in cases

of this type can always be made by 10entgen examination following the injection of oil

Cysts of the antrum usually transilluminate clearly. Roentgen examination without the injection of oil will probably show some increase in density of the involved sinus. If the wall of the cyst is punctured, straw-colored fluid will be obtained. If oil is injected following the withdrawal of this fluid, the size, location and contour of



Fig 3—*A* and *B*, chief complaint headache on the left side, transillumination clear. Primary film shows slight clouding suggestive of cyst in the left antrum. Irrigation negative. Note the extent of the cyst backward. *C* and *D*, dental cyst injected through the right lateral upper incisor tooth socket. Does not involve the antrum, but the bone has been eroded.

the cyst will be revealed by a positive shadow in the 10entgenogram. If the wall of the cyst is not penetrated and oil is injected into the sinus about it, the cyst will be outlined from without with the production of a negative 10entgen shadow.

The indications for the use of the oil may be summarized as follows. Whenever doubt exists as to the presence or nature of the disease of the sinus, radiopaque oil should be injected.

Iodized oil should not be used or, at least, should be used with caution in any person known to have toxic goiter, active tuberculosis or iodine hypersensitivity. No untoward results have thus far been mentioned in the use of the oil in the sinuses. With the advent of

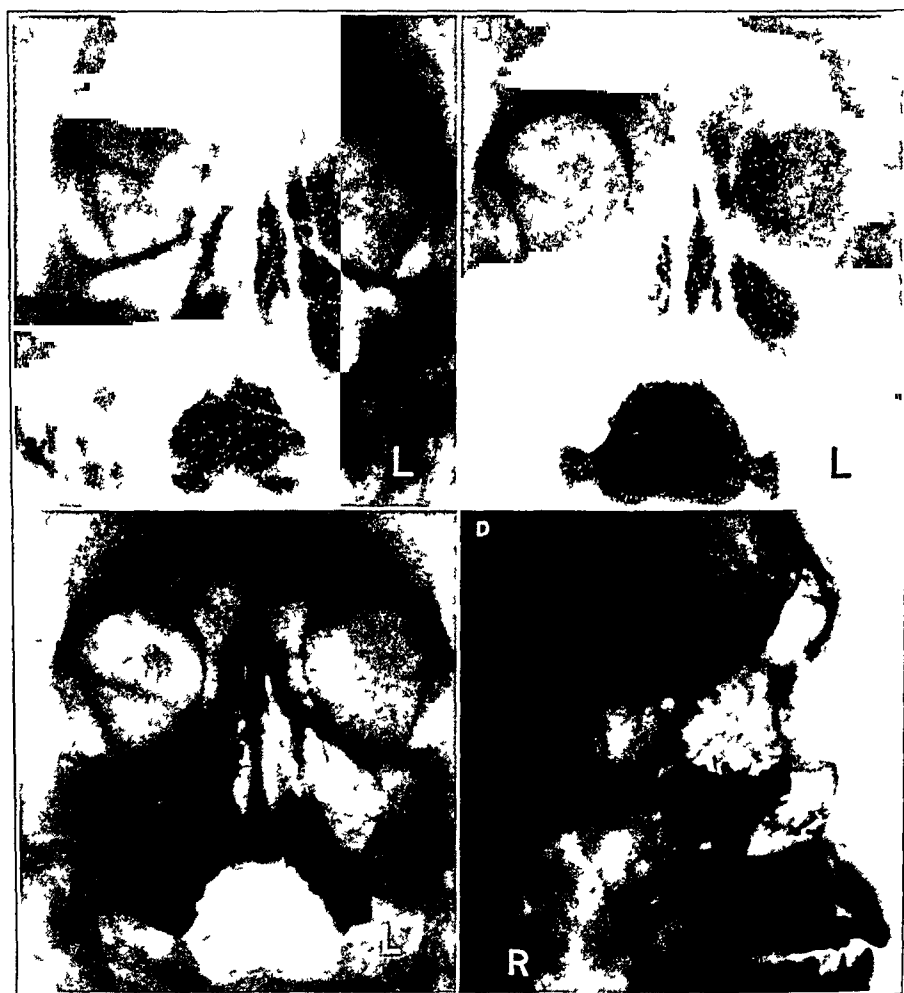


Fig 4—*A* and *B*, chief complaint rheumatism, transillumination equal and clear, irrigation of right antrum negative. Primary plate is suggestive of some pathologic change in floor of right antrum. Note the defect in filling. *C* and *D*, repeated one month after *B*.

brominized oil on the market, the present contraindications ought to be eliminated.

Two hundred and eighty-seven patients have been studied by the method described. Injections were made into 425 antrums in this series. The diagnosis of disease in fifty-four antrums was verified by operative exposure through the canine fossa. It is hoped that by more

general use of radiopaque oils, either by the injection method as first described by Fraser or by the displacement method as advocated by Proetz,³ the physiology and the pathology of the sinus will be studied in greater detail, thus, a more rational form of treatment will be evolved.

The accompanying figures are self-explanatory and show the variety of conditions in which the oil has been of material benefit in assisting to make a final diagnosis.

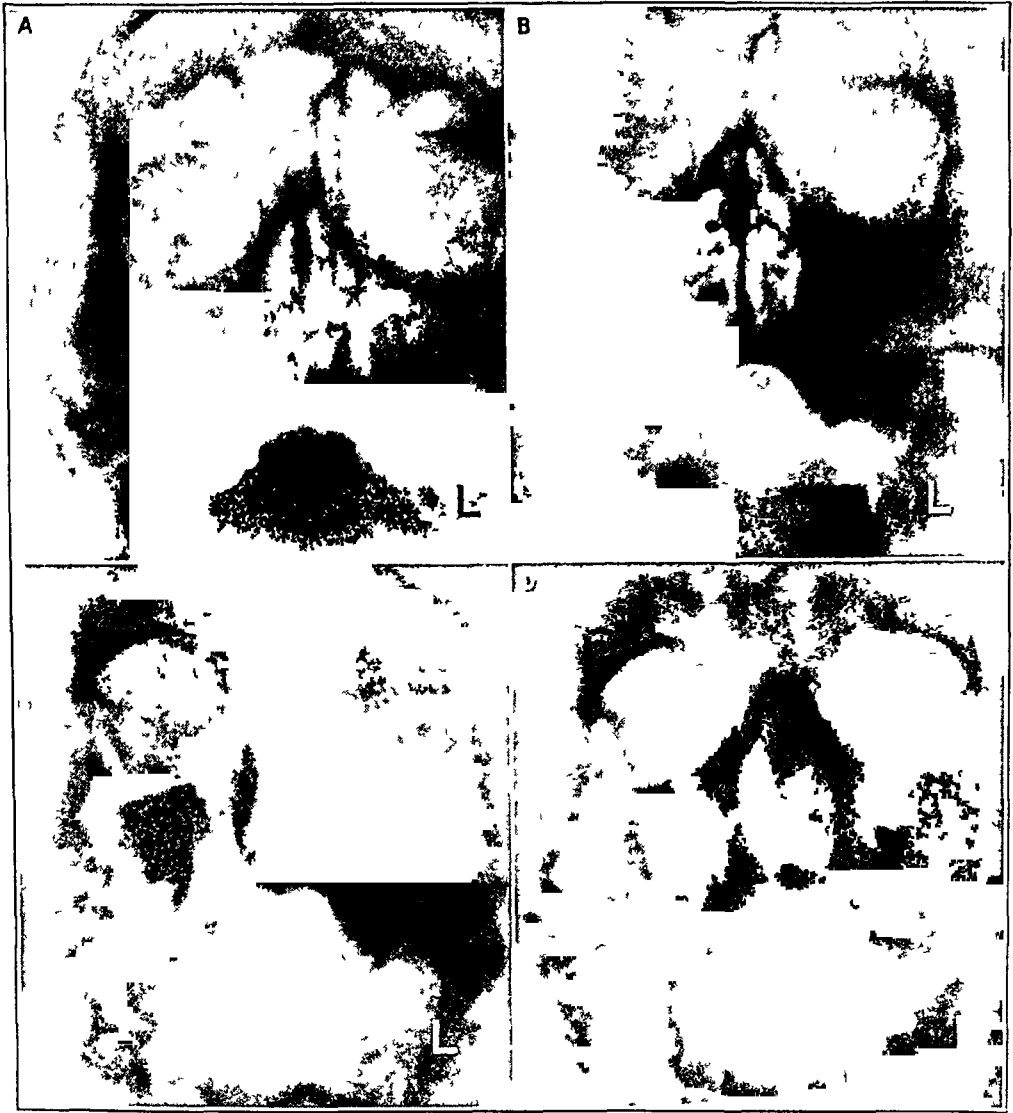


Fig 5—*A*, chief complaint similar to hyperesthetic rhinitis, transillumination equal but questionably slightly clouded, no pus on irrigation. Note the large defects in filling. *B*, same antrums two weeks later, within normal limits. The symptoms have disappeared. *C*, chief complaint anesthesia of left infra-orbital nerve, cloudy by transillumination. On irrigation obtained 2 cc of mucoid material. *D*, six weeks later, note the increase in defect. Biopsy through canine fossa revealed sarcoma—treated by deep roentgen therapy.

3 Proetz, A. W. Displacement Irrigation of Nasal Sinuses. New Procedure in Diagnosis and Conservative Treatment, *Arch Otolaryng* 4:1 (July) 1926, Further Data on the Displacement Method in Sinuses, *Ann Otol Rhin & Laryng* 36:297 (June) 1927.

CONCLUSIONS

1 Radiopaque oil can be injected into the maxillary sinus without harmful effects

2 As an aid in making the diagnosis this procedure is invaluable in the study of many obscure cases

3 If the technic of the procedure as outlined is carefully followed, reliable information is obtained

ABSTRACT OF DISCUSSION

DR ROBERT BUDD KARKEET, Portland, Ore The point on which I wish to speak is the matter of entering the maxillary sinus without making a needle puncture beneath the lower turbinate This much abused antrum is the most accessible of all the sinuses Every antrum has a natural ostium Many of these may easily be entered, and many more than is generally supposed have one or more accessory openings Schaeffer found more than 40 per cent in a large series of dissections Since it is well known that a large accessory ostium is a predisposing cause of chronic maxillary disease, it is reasonable to suppose that in pathologic cases this percentage is much greater When no accessory ostium is found and the natural opening is difficult of access, one may insert a curved needle through the membranous or undefended area in the middle meatus with no trauma There is no possibility of injecting iodized oil or other solutions underneath the mucous membrane or into the mucous membrane of the opposite wall, nor is there danger of entering the orbital cavity Of course, it is understood that the operator does not use a cannula that completely occludes the ostium One is frequently surprised to find an opening in the middle meatus as large as a lead pencil While a simple process needle puncture beneath the lower turbinate is disagreeable, particularly to a nervous patient This can easily be avoided, and I urge the surgeon to investigate the middle meatus

DR ROBERT H FRASER, Battle Creek, Mich One follows his customary and preferred method in irrigation of the sinus, and it does not matter how the oil gets in Many men like the Lichtwitz straight needle for the inferior meatus, as we do In the size 16 caliber it is satisfactory Sinuses which run when normal to 21 or 22 cc are conveniently dealt with by having such a quantity of oil in the large syringe Thinning with paraffin oil helps with the quantity and occasions no loss in the quality of detail A 5 cc syringe lets one feel the resistance of an abnormal ostium Never in the series of more than 700 cases was there evidence that the membrane was raised by the needle or was maxillary sinus shock produced For the suitable case, injection through the natural ostium, or suffusion with the patient in the prone position, does very well In any case one obtains information by which one may escape the stall on the road of successful conduct

Diagnosis is an arousing word It involves classification and nomenclature I feel that the term "chronic maxillary sinusitis" is unnecessarily vague We no longer have much profit from a consideration of sinusitis in conglomerate We must subclassify, as the essayist does, in reference to the latent type of case Chronic sinusitis is not an individual disease There are the hyperplastic, suppurative and mixed forms Neighboring but alien countrysides look alike superficially, but they follow different laws and one cannot travel far without proper deference to the individual requirements The intumescence and surface observations, as illustrated by Dr Jones, along with the equally valid history of the case, are both passport and guide along those stretches of roadway which follow

diagnosis and concern treatment—not only choice of treatment but contentment with result Granulation areas of the suppurative form are usually localized, while polyps demand survey for pansinusitis Local treatment, successful in the suppurative cases, leaves the full bloom of the disease in the constitutionally affected hyperplastic case with its serous diathesis Here spontaneous shrinking to normal is so questionable that opaque measurements are required for the assurance that any progress is real

DR HILDING C ANDERSON, Duluth, Minn I have been using the method for about two and a half years and have published several papers, one of which Dr Jones quoted, but apparently misunderstood It means that I did not write clearly This is a most valuable method, and it helps so much, especially in the catarrhal cases mentioned by Dr Fraser, and the sooner we use it extensively the better our diagnoses will be Dr Jones emphasizes that the sinus should be filled completely This is not necessary if a fluoroscope is used You can use partial filling, 4 or 5 cc of oil, place the patient before the fluoroscope and, acting as your own roentgenologist, you will get more information than from a mere film Dr Jones misunderstood me if he thought that the roentgenologist made the diagnosis and report I have always made my own examinations If there is a small amount of oil in the sinus and the patient is examined with the fluoroscope, the head being tipped in various directions, the oil is observed as it flows over the various surfaces You can swing the head to one side and bring the oil at the lateral wall, and swing it away back and get the oil at the posterior wall, then at the anterior wall—every conceivable position—and get more information than from a film Sometimes the gravity method of introducing the oil as suggested by Proetz, can be used to advantage instead of the injection by means of trocar and syringe It is especially satisfactory for frontal, for the maxillary and sphenoid, unless the tissues of the sphenoid are so thick that one cannot see clearly Sometimes that is true with the fluoroscope and one must depend on a plate It is interesting to observe the oil in the partially filled ethmoids One can study each ethmoid cell The level of the oil is maintained by gravity as the head is manipulated Each single cavity maintains its level, and one can compare the walls of one with those of the other and see how closely they come together Dr Jones said that the oil in the mucous membranes is not harmful I believe that it would only occasionally be dangerous, but having in mind the air embolism which comes from running air through the maxillary sinus, I think that one should be careful not to inject oil under the mucous membranes By irrigating first, as Dr Jones suggests, I do not believe that the accident will happen often

DR HARRY L BAUM, Denver I cannot help but feel that a discussion of this subject is of value because it directs attention to the fact that injections of radiopaque substances are now firmly established as a means of diagnosis in work on the sinus, and particularly because it emphasizes the importance of study of the films by the rhinologist himself, not depending too much on the roentgenographer I think that it is safe to say that a great many men accept the interpretation of the roentgenographer instead of studying their films carefully for their own interpretation The use of the injection method of filling the cavities undoubtedly has a place in our work, as Dr Jones has emphasized The displacement method of Proetz, on the other hand, is admirable in many conditions, but in certain states of the sinus, especially the hyperplastic type, the antrum will not always fill by displacement and then it becomes necessary to introduce the oil by other methods, either through the natural ostium or by puncture, if one desires to outline its walls I must disagree, however, with the author's statement that it is necessary to fill the cavity completely I feel, on the other hand, that it is

desirable not to fill the cavity I would rather spend the money for films and take more than one position than spend it for oil to fill the cavity completely, and take but one position. It is my custom to take not one exposure, but invariably three, in the three planes of the head, vertical, lateral and postero-anterior. We are studying cavities which in effect are round and we cannot get an idea of all of the surfaces unless we take roentgenograms in the three planes of the head. If the cavity is not completely filled, then one may define the fluid level, using always the horizontal ray, never the vertical. Thus one may study the walls of the sinus, in that way getting a better idea of configuration and membrane changes than with a completely filled cavity and the vertical ray. The other cavities, of course, cannot properly be mentioned here because this is a discussion of studies of the antrum, but I do feel that no such discussion is complete without a word—that unless the other sinuses are also studied in the same way, particularly the ethmoid and sphenoid, we shall not always do our patients justice. We may not draw the conclusions which we should be capable of in this day of radiopaque filling by the use of iodized oil.

DR E LLOYD JONES, Wheeling, W. Va. I agree with Dr Fraser in saying that it is not so important as to whether the oil is injected or put into the sinus by suction as it is to cooperate with the roentgenologist in interpreting the results. The specialist should be able to interpret the films, as Dr Baum has said. In the average town the roentgenologist is so busy doing work on the gastrointestinal tract and chest that sinuses are often neglected. As chronic infections in the sinuses seldom cause death, he is more apt to call a questionable sinus negative in contradistinction to the interpretation of the mastoids, where a questionable shadow is interpreted as definite pathologic change, in order to be on the safe side. We have used the vertical ray for several reasons. We prefer the Bucky diaphragm, and having no upright instrument we continued taking the pictures with the oil injected just as we had made them without the oil. With the sinuses completely filled I found that the pictures were entirely satisfactory, as all the sinuses operated on showed pathologic changes similar to the defects shown in the film. I wish to stress the point that this work can be done in the ordinary x-ray laboratory with a minimum amount of time and expense. It is well worth while to use it in the sinuses which might be passed as negative, but which are questionably so.

Clinical Notes

RECOVERY FROM ACUTE OSTEOMYELITIS FOLLOWING RADICAL OPERATION FOR THE CURE OF SUP- PURATIVE FRONTAL SINUSITIS

SAMUEL RUFF SKILLERN, JR., M D, PHILADELPHIA

My brother, Ross Hall Skillern,¹ recently reported a death following an extensive suppurative frontal sinusitis before the Otological Society in San Francisco, and I reported a death in a similar case at a meeting of the Eastern Section of the same society last winter in Washington, D C I shall now describe a recovery from the same condition

I believe this is one of the few cases—I can find mention of only five others²—in which the patient has been reported as living following the spreading of the osteomyelitic process after a radical operation for the cure of empyemic frontal sinusitis

There are two main divisions of osteomyelitis one which apparently occurs spontaneously, with a slow course, and tends to self-limitation, and the other a malignant form The latter is more or less diffuse, and usually follows traumatism It causes softening of the bony structure, and spreads through the canals of Breschet to involve areas of bone some distance from the original foci, leaving apparently normal bone in between Death rapidly ensues

In this case, there was a rapid spread of the infection through the medullary spaces of the frontal bone The infection seemed to jump at least 3 inches backward, leaving healthy bone from the upper edge of the cut surface of the frontal plate back to the frontoparietal suture line, where the infection broke through to the scalp

The original incision had healed nicely The stitches were removed on the fifth and seventh days, and the drainage tube on the tenth day The patient was discharged from the hospital as convalescent sixteen days after the operation Five days later, or twenty-one days from the time of operation, he was readmitted for the new area of infection

¹ Submitted for publication, Sept 9, 1929

¹ Ross Hall Skillern An Extensive Case of Acute Osteomyelitis of the Frontal Superior Maxillary Bones, Complicating Sinusitis Operation, Apparent Recovery, Sudden Death, read before the American Laryngological, Rhinological and Otological Society, at San Francisco, July, 1929

² McClay J Laryng & Otol, 1921, p 478 Bulson Tr Am Acad Ophth & Otol, 1925, p 102 McKenzie J Laryng & Otol 42 293 (May) 1927 Hastings Tr Am Laryng A, 1927, p 46 Shea Tr Am Laryng, Rhin & Otol Soc, 1928, p 401

REPORT OF CASE

The morning of August 16, I received a telephone call from the local surgeon of an adjacent city asking me to see a desperately ill boy and to be prepared for a radical frontal operation if I thought it necessary.

I found a boy, aged 18, confined to bed, in a very toxic condition, with his head swathed in bandages. He was attended by his physician, nurse and anxious parents. The following brief history was obtained:

The day after an afternoon of swimming, on July 27, the patient complained of a severe frontal headache, for which he consulted his family physician and obtained some headache tablets. The headache was progressive, finally requiring hospitalization, due to a fluctuating swelling 1 inch (2.5 cm) above the inner canthus of the left eye. This was opened on August 3. The temperature at that time was 103 F. Four days later, a frontotemporal and a septal abscess required opening. On the eighth day, a second septal abscess was opened, with free drainage of foul-smelling pus.

On the twelfth day, the patient seemed to be irrational at irregular intervals and had great difficulty with his speech. On the morning of the thirteenth day, his mind seemed clearer, at this time, a roentgenogram was made of the sinuses.

When I saw the patient, he was moribund but could be aroused to answer questions. His cerebration was extremely slow, he would often give an incorrect answer, and then, after a pause of several minutes, would correct his statement.

When the dressings were removed, I found the forehead bathed in pus. A piece of rubber tubing had been carried through and through under the skin for drainage of the frontal area.

The laboratory report was a high leukocyte count (from 12,500 to 15,000), a low red cell count (from 4,000,000 to 3,000,000) and a progressive decline in hemoglobin (70, 65, 60 per cent). There was acute glomerular nephritis, with increasing hyaline and granular casts. The Wassermann reaction was reported to me as negative.

The interesting point of the physical examination was the general weakened, anemic condition, numerous moist râles at the base of the lungs and a flabby heart muscle.

The family was advised of the precarious condition of the patient, and an immediate operation was recommended as a life-saving measure. Operation was performed within the hour.

The usual eyebrow incision was made, and a second incision was run upward around the abscess drainage opening. This flap was dissected upward, the muscle and fascia around this opening were found to be necrotic. The openings through the frontal plate were filled with degenerated polypoid tissue, granulations and pus, and the bone around the edges had a stiff, putty-like resistance. The entire anterior plate of the frontal sinus was removed, from one-fourth inch (0.6 cm) above the supra-orbital rim to the outermost confines of the sinus, where the edges were beveled outward as much as possible.

The intersinus septum was removed in its entirety. The posterior plate contained four necrotic cuplike depressions varying in size from that of a pea to that of a large bean, and required such strenuous curettement that my assistant afterward told me he held his breath in fear that the curet would perforate into the cranial cavity.

After all areas of infection were removed as thoroughly as possible, the frontal ostium was enlarged by rasp and chisel and the wound irrigated with a 1:5,000 solution of mercuric chloride. A rubber drainage tube was run from the center

of the sinus through the enlarged ostium to the nostril, the periosteum and soft tissue were closed with catgut and the skin with silkworm gut

Rather vigorous stimulation was required during the first twenty-four hours of the postoperative treatment. Irrigations through the drainage tube of the frontal sinus with a 1:5,000 solution of mercuric chloride were given until the irrigating fluid returned clear. These irrigations were used morning and night as long as the drainage tube remained in situ, after its removal, the nasal cavities were washed daily with a physiologic solution of sodium chloride until the patient was discharged from the hospital on the sixteenth postoperative day.

On the twentieth postoperative day, Dr. Gotwals, the attending surgeon, called me and stated that the osteomyelitic process had extended backward, and that there was an abscess in the scalp in the center line of the head directly over the fronto-parietal suture.

I advised free incision and the removal of all infected bone. He afterward told me that it was necessary to chisel a canal a half inch (1.2 cm) wide from the top of the head to the outer edge of the eyebrow. It was necessary to resect the entire thickness of the bone, exposing the dura for over half the length of the incision. A dressing saturated with a 1:5,000 solution of mercuric chloride, which was changed hourly, was used until the wound healed by third intention.

Five months later, the patient reported to my offices with a large scar fully half an inch in breadth, extending from the top of the head to the hair line of the left eyebrow. There was a small discharging sinus at its lower end. The removal of a small sequestrum and the application of 90 per cent silver nitrate healed this sinus. There was also a small sinus over the inner angle of the eye, which contained a drop of pus.

I sent the patient to Dr. Widmann for roentgen examination. Somewhat to my surprise, the negative showed a complete regeneration of the frontal plate. There was one small scooped-out area of roughened bone in this newly formed plate, which Dr. Widmann thought was an area of healing infection.

I have since removed four small spicules of bone. At the present time, the sinus is entirely healed.

The middle of March, this patient reported to me, as he was greatly alarmed over a small swelling which had occurred in the center of the upper left eyelid just below the bony orbital ridge. Examination showed a freely moving mass the size of a dried pea, directly beneath the skin. This was kept under observation for two weeks, and, as there was no apparent change, it was tapped with a twenty-four gage hypodermic needle, without result. As I thought it might be thick pus, a small stab wound was made, the knife gave the fingers the sensation of cutting cartilaginous tissue. Four days later, this wound discharged several small drops of pus, and the mass disappeared.

On May 1, the patient reported to me and appeared to be in excellent condition. Dr. Elmer Gotwals furnished the following history of the patient.

History—N. C., a school boy, aged 18, white, American, gave as his chief complaint, pain in the left side of the face above the left eye.

Physical Examination—The young man, measuring 5 feet, 10 inches in height and weighing 145 pounds (65.7 Kg), was well developed physically and showed an excellent state of nutrition. There were no eruptions on the skin of the face or the body. The pupils were equal and reacted to light and in accommodation. No congestion of the conjunctiva was seen. The muscle action of the eyes was not impaired.

Examination of the nose showed that the septum was not deflected, the turbinate bones were slightly enlarged and congested, especially on the left side. Some

mucous secretion came from the nose. The teeth and the gums were in excellent condition. The tongue was slightly coated. The tonsils were not enlarged. The nasopharynx was slightly congested. There were no enlarged cervical or epitrochlear glands.

The chest revealed equal expansion. There were no râles or areas of impaired resonance.

The heart revealed nothing abnormal, the beat was regular, and there were no murmurs.

There were no palpable masses in the abdomen or any tender areas. The abdomen was not distended.

The extremities were normal, as were all the joints.

Previous Medical History—The patient had always been well. He had never lost any time in school because of illness, and had been well all summer. On July 27, 1928, he swam in a stream of dirty water, while diving, he got more water than usual up his nose. The next day, he noticed a cold in the head. He sneezed and had a discharge from the nose, but no fever. On July 30, during the night he began to have pain in the left side of the face above the left eye, radiating over the forehead. He consulted me on July 31, at 2 p. m. At that time, he was complaining of much pain in the left frontal region. He had a slight elevation of temperature—100.2 F, the pulse rate was 80, and the respirations 20. He was advised to go home and go to bed. Appropriate treatment was started. He slept only at short intervals that night and complained of excruciating pain in the "frontal region" of the head.

Pain and restlessness continued the next day and night, August 1 and 2. At this time there was swelling, redness and marked tenderness above the left eye over the frontal sinus.

There was no free discharge from the nose, but the turbinate bones were greatly swollen. During the early part of the night of August 2, the pain was still marked. The patient was uneasy and nauseated, and vomited. About 2 a. m., August 3, the pain suddenly ceased, and the patient went to sleep. When I saw him in the morning, I found the left eye entirely closed, marked redness and swelling above the left eye to the midline. There was a slight mucopurulent discharge from the nose. The patient showed shock and was very ill. Above the left eye there was fluctuation extending to the midline, the forehead and around the base of the nose.

At this time the patient was moved to the Phoenixville Hospital. On admission his temperature was 103 F, the pulse rate was 96, and the respirations 24. A blood count at this time showed red cells, 4,470,000, white cells, 15,000, and hemoglobin, 70 per cent. The differential count showed polymorphonuclears, 78, small leukocytes, 11, large leukocytes, 8, and transitionals, 3. The urine showed a trace of albumin and a few hyaline casts, it was otherwise normal. The heart, lungs and abdomen were normal, as was the nervous and mental condition. The patient was slightly septic and dull. After consultation, it was decided to operate. An incision was made in the midline above the base of the nose, and a drainage tube was inserted. There was a free discharge of pus from the incision. There was no bone resection at this time. The temperature dropped to 101 F, and the condition of the patient was better.

The next day, the temperature rose to 102 F, and stayed between 100 and 102 F for several days. The swelling and edema around the eye continued. The patient remained dull and stupid, he experienced much headache, sleeplessness and loss of appetite. On August 7, fluctuation was discovered at the outer and upper border of the left eye. The patient was given nitrous oxide anesthesia, and an incision was made above the left eye, a tube was inserted, connecting the opening

made on August 3 in the midline. There was a free discharge of pus at this time. The temperature dropped to normal, the pulse rate to 80 and the respirations to 20. The condition of the patient was much better for the next three or four days. The temperature was not above 100 F. The patient slept better and took more nourishment. There was free drainage from both incisions. There was also fluctuation on the left nasal septum, which was punctured, followed by free drainage.

On August 11, I left for my vacation and turned the case over to Dr. C. F. Doran. Four days later, Dr. S. R. Skillern, Jr., was called in consultation.

On assuming charge of the case again, one week after the sinus operation, I found, about $1\frac{1}{2}$ inches above the incision, a small opening in the scalp from which pus was being discharged. There was little discharge each day. On August 23 the temperature was normal, it was not elevated until August 27, and then only a little. The patient was now eating well and gaining in strength rapidly. He was allowed to get out of bed, and he soon walked about, he was allowed to go home on September 4. There was still some discharge from the opening in the scalp above the sinus incision. After being home for two days the patient complained of more headache, some nausea, poor appetite and sleeplessness. At this time, the discharge from the scalp became free. In the left frontal and parietal region, the scalp became tender, swollen and boggy. The upper left eyelid was swollen. Pus was being discharged from the outer end of the incision of the sinus operation. A diagnosis of osteomyelitis of the scalp was made, and the patient was removed to the hospital on September 10. A consultation with Dr. Skillern was held by telephone. He advised free incision until healthy periosteum and bone were reached, the resection of all diseased bone, and that the wound be packed with salvaged gauze, kept continuously moist with a 1:10,000 solution of mercuric chloride and the incision allowed to heal by third intention. A long incision was made extending from the temporal region diagonally toward the midline of the scalp back to the crown of the head. A counter incision was made extending to the left zygomatic fossa. There was marked edema of the skin and pericranial tissue. The periosteum was honeycombed in many places. The midline incision was continued until healthy periosteum was found. A small counter-incision was made in the frontal region above the left eye. This large area was then curetted, and the outer plate of the skull was entirely removed. The bone was honeycombed in many places, the cancellous tissue was soft, gelatinous and full of pus. A small island of the outer plate was left over the left ear, and one near the midline at the crown. In several areas the inner plate was so thin the pulsations of the brain were transmitted through it. The incision was not sutured, but was packed with gauze saturated with a 1:10,000 solution of bichloride of mercury. This was kept well saturated continually and was repacked daily. Recovery was uneventful.

The temperature ranged from 98.3 to 99.4 F., and the pulse rate from 80 to 100. The patient was out of bed on the third day. He was discharged from the hospital on the fifth day. On the tenth day, when the infection seemed to be well under control, sutures of silkworm gut were placed in the outer ends of the incision and the counter incision in the temporal region. This was done for cosmetic results. These sutures were tied with a double straight knot, and each day were drawn tighter. After three weeks, both ends of the incision were healed perfectly, the juncture of the three incisions was then the only open area. Small pieces of sequestrum were removed from the midline incision about four weeks after operation. The incision was entirely healed by October 30. The patient is now gaining in weight, eating well and, barring headache at times, is in excellent condition.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

TONSILS AND ADENOIDS

FRENCH K. HANSEL, M.D.

ST. LOUIS

In reviewing the literature for 1929 on the tonsils and the adenoids, I have selected only those papers which promote discussion and those which, according to my judgment, show the advances made in this particular field of otolaryngology during the past year. A great deal of interest on the subject of rheumatism and arthritis and their relation to the tonsils and adenoids has been shown in several interesting papers. Kaisei, who has made extensive studies of rheumatism in a large group of cases extending over a period of several years, continues to report the results of these observations. Waldapfel, Claus and others have continued their investigations on the subject of postanginous pyemia and report further studies on the histopathology of the tonsils and peritonsillar tissues.

GENERAL CONSIDERATIONS

Burnett and Piltz presented a series of 100 patients who, following some acute infection, were especially studied with reference to possible injury of the heart. None of these had shown any signs or symptoms of heart disease prior to the recent infection. No cases of scarlet fever, diphtheria or frank rheumatism were included, and none of these patients gave a history of rheumatic fever, twenty-eight furnished significant changes in the electrocardiogram. In twenty of these, symptoms and other signs of heart disease were lacking or confusing, and in only three of the twenty-eight were either heart signs or symptoms sufficient to indicate injury. Pathologic and clinical evidence support the view that in the course of many types of acute infection the tissues of the heart are injured. Clinical recognition of this injury is often difficult or impossible. The electrocardiogram offers a means of diagnosis in a sufficiently large proportion of these cases to render its more general employment worth while.

Of 413 rheumatic children observed by Wilson and his co-workers over a period of from one to ten years, 247 were subjected to tonsillectomy. Manifestations of infection recurred in 47.7 per cent and

appeared for the first time in 34.7 per cent of the treated children. In only 17.5 per cent was there no manifestation of rheumatism after the operation. In rheumatic children less than 9 or 10 years of age, recurrent attacks were frequent, whether or not tonsillectomy had been performed. In older children recurrent attacks became less frequent regardless of enucleation of tonsils. The age at which tonsillectomy was performed and not the fact of tonsillectomy appeared to be the significant factor in the incidence of nonrecurrence of infection after operation.

Two hundred tonsillectomies in cases of subacute rheumatism, infective arthritis, fibrositis, osteoarthritis, neuritis and sciatica are reviewed by Pavey-Smith. He stated that a probable focus in the tonsils can be found in a large number of these cases. In selecting cases for operation, a history of tonsillitis associated with onset or recurrences is favorable in cases of infective (focal) arthritis, and to a lesser extent in subacute rheumatism, in which such a history is commoner. The younger the patient, and the shorter the duration of disease, the better the prospects, but within very wide limits neither age nor duration is a bar to success. The bacteriologic evidence, though insufficient to convict *Streptococcus viridans* as the primary infective agent in chronic focal arthritis, increases the suspicion under which this organism already lies. In subacute rheumatism the results are so good that the operation should become a routine part of the treatment, if only as a prophylactic against recurrences and later endocarditis. In cases of chronic focal arthritis, if the balance of evidence condemns the tonsils and they are completely excised, improvement may be expected in 80 per cent of cases.

The analysis of 439 rheumatic children made by Kaiser disclosed the following facts. The most susceptible age for the first attack of rheumatism is between 8 and 14 years. In nearly twice as many children in the community studied, the first attack of rheumatism developed when the tonsils were still present. Recurrent attacks of rheumatism occurred 10 per cent less often in children who had their tonsils removed after the first attack of rheumatism than in those whose tonsils were not removed. The incidence of carditis as a complication in acute rheumatism was nearly as frequent in children who had undergone tonsillectomy as in those who had not. Chorea occurred as a complication in acute rheumatism with equal frequency in children operated on and not operated on, but the association of carditis with chorea was less in children whose tonsils had been removed. Tonsils are the avenue of infection in many cases of rheumatism and bear a definite relationship to this disease. Their removal should be advocated in the rheumatic and potentially rheumatic child until more is known of the etiology of rheumatism.

Findlay and his co-workers concluded that preliminary tonsillectomy may possibly render a person less susceptible to rheumatic arthritis but

not to chorea Preliminary tonsillectomy, or tonsillectomy performed early during the course of the infection, may possibly, in the case of arthritis, render the heart less liable to be attacked, but not so in the case of chorea As, however, cardiac complications usually ensue during the first or second rheumatic manifestations, the operation, to be prophylactic, must be performed before the second attack Tonsillectomy in the case of carditis following arthritis seems to have a beneficial effect on the progress of the disease, but not so in carditis following chorea The evidence in favor of the beneficial effect of tonsillectomy in the case of rheumatic manifestations characterized by arthritis is, however, slight The varying behavior in response to tonsillectomy of examples of the rheumatic infection characterized by chorea and by arthritis suggests the possibility of a different strain of the infective agent in these two types of the disease

Clarke pointed out that the geographic distribution of *Ceratophyllus fasciatus*, the common rat flea of northern temperature climates, and rheumatic fever is so similar as to make it seem possible that the insect is in some way connected with the etiology of the disease These similarities are those not only of geographic and local distribution but of temperature and humidity, temperature being the more important Rheumatic fever does not enter through those conditions of the throat which seem to be caused by overcrowding and bad ventilation, such as occur in the public schools, but there may be an association with the inflamed throats which are caused by the access of drain and sewer gas into houses Defects of sanitation may admit drain gas into dwellings but they may at the same time admit the rat with its flea However the fact that the disease may occur without an inflamed throat suggests that it is the flea and not the gas which carries rheumatic fever

Zikowsky stated that among 1,013 patients with scarlet fever only twenty-three had previously undergone tonsillectomy Whether this is due to the fact that persons whose tonsils have been removed are less susceptible to scarlet fever infections, or to the circumstance that only a small percentage of the population of Vienna undergo tonsillectomy could not be ascertained Many of the patients whose tonsils had not been removed developed serious complications During the first week the tonsils were usually red and swollen and showed yellowish strips or spots Later, these swellings disappeared, but a sort of secondary scarlet fever developed in the form of the typical scarlet fever glands If the vitality of the patient was much reduced and the organism was not strong enough to combat this second attack, such complications as acute nephritis and otitis media developed Dangerous also was lymphadenitis which frequently followed tonsillitis or peritonsillitis A careful observation of the twenty-three patients who had undergone tonsil-

lectomy proved that the scarlet fever in these patients was usually milder and showed fewer complications. Conditions of the heart and arthritis caused by scarlet fever were nearly the only complications noticed in these cases. Zikowsky does not make a concluding statement concerning tonsillectomy. He expressed the belief, however, that the tonsils are an important factor in scarlet fever. He assumed them to be the depository of the scarlet fever virus, and probably also the portal of entry for the disease.

Tonsillectomy has been advocated not only to relieve symptoms referable to diseased tonsils themselves, but as a means of protection against subsequent infections. Schick and Topper have made the Schick test on every child who came to the hospital for tonsillectomy. They found a fairly large number of children who showed a positive reaction to the diphtheria test before tonsillectomy. Six months after tonsillectomy, 100 children were retested. In eighteen children the reactions still remained positive, and in eighty-two the results were negative, in eleven of the sixty-one younger children (6 years of age or less) the reaction remained positive, while in fifty it became negative, in seven of the thirty-nine older children (more than 6 years of age) the reaction remained positive, while in thirty-two it became negative. The authors do not advocate indiscriminate tonsillectomy. They are still emphatically in favor of immunization by toxin-antitoxin. However, there are two practical applications to be considered: (1) the recommendation of tonsillectomy in place of immunization with toxin-antitoxin for children with diseased tonsils who are sensitive to horse serum, (2) the recommendation of testing children who have been tonsillectomized six months or more previously before immunizing with toxin-antitoxin.

Aycock and Luther reported that in 497 of 714 cases of poliomyelitis, tonsils were present, and in 217, tonsillectomy had been done at some time prior to the attack of poliomyelitis. Figures from the Massachusetts department of public health show that of 10,098 school children examined, 3,281, or 32.9 per cent, had had tonsillectomy. The age distribution of the school children represented in these two sets of figures is not available for a more exact comparison, with regard to tonsillectomy, between school children in general and those with poliomyelitis. However, the percentage of cases of poliomyelitis in which there was a history of tonsillectomy is so near that of school children in general that the presence or absence of tonsils does not seem to influence the occurrence of poliomyelitis to any considerable extent. The interval elapsing between tonsillectomy and the onset of the disease in this group of cases corresponds to the incubation period of the disease as indicated by other evidence. This suggests that in such rare instances the setting up of infection by the virus of poliomyelitis is in some way associated with tonsillectomy.

LaMotte reported three cases of acute infectious mononucleosis and referred to others reported in the literature. The first patient was a boy, aged $5\frac{1}{2}$ years, who had fever and enlarged cervical glands for four months. The tonsils were red, large and somewhat embedded. The white blood count was 14,500, with polymorphonuclears, 25 per cent, small mononuclears, 70 per cent, large mononuclears, 2 per cent, transitionals, 1 per cent, and eosinophils, 2 per cent. The tonsils were removed, but the temperature returned to normal only after a period of eighteen days. The second patient was a boy, aged 13 years, and the third a girl, aged 19 years.

Brown expressed the belief that infected tonsils act as definite foci in cases of toxic goiter and should be removed in all cases of this type. In a study of fifty cases, thirty were considered of the toxic type and required both thyroidectomy and tonsillectomy to relieve all symptoms.

Brooks examined a group of 15,000 school children to determine the incidence of ear, nose and throat defects. Tonsillectomy had been performed in 3,358, or 23 per cent, 175, or 5.2 per cent, showed poor results. Pieces of tonsils were still remaining in various parts of the tonsillar fossa. Injury to the soft palate resulted from scarring of the pillars. Snaring of the uvula also occurred in certain cases. In conclusion, Brooks made a plea for more painstaking operations on the tonsil and a more careful following of all operative work.

Bailow pointed out the value of barbital before local anesthesia. It neutralizes the toxic action of cocaine and procaine hydrochloride. From 5 to 10 grains (0.32 to 0.65 Gm.) of barbital by mouth are administered one hour before operation.

Evans reported a brief summary of his personal experience and observations based on approximately 6,000 tonsillectomies in which nitrous oxide-oxygen alone was used for the anesthetic and approximately 10,000 in which nitrous oxide-oxygen-ether was employed. The appetite usually returns more quickly, and there is less nausea and vomiting when no ether is used. For children under 3 years of age the addition of a trace of ether with a higher percentage of oxygen is recommended.

In a review of the literature, Drosler found only one case of unquestionable primary tuberculosis of the tonsil. He reported an instance of this condition observed personally in which the death of the patient from bronchopneumonia made it possible to demonstrate conclusively, by careful postmortem examination, that the tuberculosis of the tonsils was primary.

Delavan emphasized the necessity for a scientific investigation of the causes of hypertrophy of the lymphoid elements of the pharynx. He called attention to the common prevalence of this unpleasant and trou-

blesome complication and recommended that this problem be thoroughly studied from a scientific standpoint

In the discussion of tumors of the tonsil, Dunn emphasized that primary malignancy is not as uncommon as it was formerly thought. Early diagnosis is important, and the tonsil or peritonsillar area should not be disturbed by puncture when symptoms of infection are absent. When biopsy is taken, the cautery should be used to excise the tissue. Although cautery excision of the growth is advisable, treatment in all cases should include roentgen irradiation.

According to Boyce, the majority of middle ear infections, frequently extending to the mastoid and internal ear and sometimes causing chronic deafness or fatal intracranial complications, develop as the result of inflamed and hypertrophied adenoid tissue in the pharynx. By obstructing the breathway and interfering with reception into the lungs, enlarged adenoid masses may actually reduce the opportunity for thorough aeration of the blood. This gives rise to early fatigue, congested head, sleepy eyes and aprosexia and may be a large factor in the production of severe neuroses, such as chorea and epilepsy. Adenoids may be the focus from which infections in other parts of the body arise, as is more frequently the case with the faucial tonsils, but because of their obscure situation, the adenoids may escape scrutiny in this connection.

Nelson made a clinical study of adenoids in adults. Of nineteen cases of demonstrable adenoids, twelve were of clinical importance. Ten per cent of ninety-five adults seen consecutively with chronic tonsillitis had adenoids. Tonsillectomy had been performed in six cases, without attention being given to the adenoids. Frequent acute rhinitis and nasal congestion without demonstrable infection of the sinuses were present in more than half of the cases. In twelve, nasopharyngeal hyperemia seemed at least partly due to infection of the adenoids, and in seven a discharge of an inflammatory secretion independent of sinusitis was present. Several patients had disease of the middle ear related to the adenoids. Adults should be even more carefully examined than children, and adenoidectomy should accompany other operations on the nose and throat when adenoids are found. The conception that they do not occur in a pathologic state in adults should be guarded against.

ANATOMY AND PHYSIOLOGY

On the basis of his personal studies and a review of the literature on the topography and mechanism of the tonsils, Chorionshitzky came to the following conclusions. The analage of the tonsils is developed in the interarcual tonsillar fossa under increasing positive pressure, thus concentric layers of the peritonsillar connective tissue result, which form the basis of the capsule in the deep-seated tonsil. The pedicle

tonsil however, has no capsule. The last type of tonsil, therefore cannot harbor a subcapsular abscess, and expulsion of its contents is far more than in the deep-seated tonsil. The double lobe of the tonsil is due to persistence of the embryonic intratonsillar fold as von Hammar stated. The capsule caps the outer and upper surface of the tonsil enclosing the fossa supratonsillaris. The fringe of the tonsil lies between the mucous membranes of the side wall of the pharynx and the inter-arcual fossa. It is due to this cap that the enucleated tonsil appears on frontal section shaped like an arabic 6. On its dorsal surface, the subcapsular abscess forms protuberance of varied size. Evacuation of chronic subcapsular abscesses is of far-reaching importance in various diseases of the tonsils. However, opening of a peritonsillar abscess with a stump hook by way of the lacuna is dangerous, and the result is doubtful. Recurrences after tonsillectomy are prevented only if the entire tonsillar fossa is enucleated.

Trotter made a study of the function of the muscular attachments of the tonsil, and from the results of this investigation his conclusions are

It has been observed by stimulation of the nerve endings or terminals in the mucous membrane of the fauces, the pharynx and the tonsil, that a reflex action occurs which effects the muscles adjacent to the tonsil. By means of the conjoined contraction of the muscles, associated with the tonsil which cross and intersect intricately, pressure is exercised upon the upper pole of the tonsil, causing this portion to move outward and slightly forward toward the median line of the fauces. Pressure is also exerted upon the tonsil laterally by means of the palatoglossus and palatopharyngeus muscles. The contraction of the tonsillopharyngeus muscle, which occurs simultaneously with the upper musculature, directs the movement of the tonsil inward and this causes the tonsil to tip. The traction caused by the plica semilunaris in the tonsillar excursion and deviation from the vertical plane affects the upper portion of the tonsil, which causes a mechanical eversion of the organ, producing a mechanical expelling action or disgorgement of the tonsillar pouches and crypts. By this method the tonsil throws off the excessive exudate, food particles, cellular debris and bacteria and frees the pouches and crypts of foreign material and promotes drainage.

BACTERIOLOGY AND PATHOLOGY

Nabarro and MacDonald are convinced that streptococci isolated from the tonsils of persons with rheumatism do not differ materially from those isolated from the nonrheumatic person. This absence of difference fits in with the theory that there is no specific streptococcus which is the cause of rheumatism, but that the condition is due to a hypersensitiveness resulting from repeated small doses of toxin. The tonsil is probably one of the foci from which these toxins may be absorbed. For this reason, in spite of the lack of difference mentioned,

tonsillectomy in rheumatic cases is probably a valuable prophylactic and therapeutic measure

During the six months from November 1927 to May 1928 Polvogt and Crowe made cultures from the interior of the tonsils and adenoids removed at operation in 100 selected cases. Patients with a history of repeated attacks of tonsillitis were selected for this study. More than 50 per cent were children under 11 years of age. Their object was to determine (1) the predominating organism deep in the crypts (2) whether the organisms recovered from the tonsils in patients with some general systemic disorder (tonsillitis arthritis or nephritis) differed in any way from those recovered from the tonsils in patients with local symptoms only (tonsillitis) and (3) the carrier state. It is well known that acute tonsillitis is due to the hemolytic streptococcus. They were interested in determining whether this organism was still predominant at the time of the operation—from three weeks to six months after the last attack of acute tonsillitis. The hemolytic streptococcus was the predominating organism grown in 91 per cent and the staphylococcus in 8 per cent. In one case no growth was obtained. There is no apparent connection between the predominating type of organism found in the tonsils and the clinical symptoms. The majority of these cultures were made during the winter months and all were made between November 1927 and April 1928. More than 50 per cent of the patients from whose tonsils a hemolytic streptococcus was grown in pure culture were children under 11 years of age. The majority of those in whom a staphylococcus was the predominating organism were over 25 years of age. The average time between the last acute attack of tonsillitis and the tonsillectomy was one month. In eighty-one cases the hemolytic streptococcus was the predominating organism in both the tonsils and the adenoids. In eight there was a heavy growth of staphylococcus from both the tonsils and the adenoids. In ten there was a heavy growth of staphylococcus from the adenoid culture and a pure culture of streptococcus from the tonsils. A culture made by swabbing the surface of the tonsil is a reliable index of the predominating organism in the crypts.

Ramsay and Pearce stated that although much may be learned by an experienced observer from an inspection of the tonsils in situ, and from any history which bears on them the standards of assessment as to their normality or otherwise have been somewhat arbitrary hitherto and the personal factor must of necessity play a part in the examining physician or surgeon. They have tried to arrive at a more accurate estimate by means of direct puncture into the substance of the tonsil with subsequent investigation of the aspirated material on lines which have been standardized. Of 158 tonsils examined by this method of puncture from patients varying in age from 5 to 51 years seventeen were found to be

sterile on culture. Streptococci were present in pure culture in 111 cases, and with other organisms in twenty-six cases. With fermentation tests 81.2 per cent gave reactions for *Streptococcus pyogenes* and 18.8 per cent gave reactions for *Streptococcus viridans* or *mucosus*, 56.5 per cent of the streptococci were facultative anaerobes and 7.8 per cent gave a hemolytic reaction on hemoglobin agar. Diphtheroids were present in four cases, staphylococci in eighteen cases (three in pure culture), pneumococci in five cases (one in pure culture), and *Bacillus influenzae* in one case. One patient who showed staphylococcal infection of the tonsil was suffering from sties and from a pustular eruption on the ear. Should the tonsil be found to be infected, the organism can be tested against the patient's blood and some idea of the resisting power of the latter to the organism can be obtained. If the immunity of the blood is found to be impaired, removal of the tonsils is probably desirable, other things being equal. The uses and future possibilities of the method are discussed, particularly in relation to puerperal septicemia and to rheumatic carditis in children.

On the basis of a review of the literature and his personal study on twenty-five pairs of tonsils derived from tonsillectomies and fourteen pairs from necropsies, besides experiments on eleven rabbits, Brunner stated that under normal conditions the tonsils have a low iron content. Iron is more often evident in material obtained from necropsies than in tonsils derived from tonsillectomy. It is accumulated on the borderline between lymphatic tissue and the capsule, in the lymphatic tissue itself and also toward the outside of the follicle. Pigment without iron is found, on the whole, in the same place as pigment containing iron. Deposition of iron and pigment is most frequently due to resorption of a pathologic hemorrhage caused by trauma or an inflammation. It may also be associated with hemolysis occurring in the tonsils under certain conditions. Iron derived from the blood circulation is likewise deposited. Following intravenous injection of a small amount of colloidal iron into rabbits the iron is first deposited in the wall of tonsillar veins, then also on the wall of the capillaries. In this respect, they are to be distinguished from the lymph glands. However, as the endothelium of vessels in the tonsils is impermeable for colloidal iron and accumulation of iron in the reticular cells is thus prevented, the tonsils resemble lymph glands, but are at variance with the behavior of the liver, spleen and bone-marrow.

In a study of pathologic changes in tonsils, Wilkinson examined 10,000 pairs of tonsils, with special reference to the presence of cartilage, bone tuberculosis and bodies suggestive of actinomycosis. After a complete compilation of the data in the 10,000 cases, it was found that in 8,573 cases there was nothing of unusual interest. The only disclosures rela-

tive to pathologic changes were various grades of fibrosis, pus and ulceration. The remaining 1.427 cases represent that proportion of tonsils in which there were pathologic processes other than those due to the usual inflammation and pathologic change.

Wilkinson's conclusions in this most comprehensive work on the tonsils are as follows:

1. All tonsils show evidence of chronic infection, if the presence of leukocytes in the crypts and ulceration of the epithelium are an indication of infection.
2. In 1.427 per cent of tonsils there are pathologic changes of bizarre types.
3. In 11.21 per cent of tonsils there are cartilage and bone in various grades and proportions.
4. Cartilage occurs in relatively larger amounts than bone.
5. Chronic infection is a great and definite factor in the production of fibrosis.
6. Fibrosis is relatively increased in cases in which there is cartilage and bone.
7. Chronic infection is an inciting factor in the production of cartilage and bone.
8. Fibrosis increases independently of infection and in direct relationship to age.
9. Bodies similar to those found in cases of actinomycosis occur second in order of frequency in pathologic conditions of bizarre type in the tonsil.
10. Tuberculosis of the diffuse type has an incidence of 0.52 per cent, and is on the decline.
11. In 0.17 per cent of tonsils there is bilateral involvement with tuberculosis.
12. The percentage frequency of occurrence of cartilage and bone is increased in cases of diffuse tuberculosis of the tonsils.
13. Cholesterol can be seen in 0.63 per cent of tonsils.
14. Foreign-body giant cells and cholesterol are associated with each other in chronic degenerative processes of the tonsils.
15. Trichinae are present in 0.06 per cent of extirpated tonsils.
16. There is sufficient pathologic change of interest in the tonsils to warrant routine microscopic examination of removed tonsils.

Fetissow defined as sore throat (angina) any acute nonspecific inflammation of the entire pharynx or of certain parts of it such as the tonsils. He also discussed the terminology of the various symptoms. On the basis of a brief review of the literature and his personal study of four cases, he contended that theoretically the most rational division would be into two groups. In simple or superficial catarrhal sore throat an increased output of lymphocytes and leukocytes in the epithelium is seen, without causing, however, destruction of the epithelium; on the surface of the tonsils an inflammatory exudate is formed. Their tissue is swollen and edematous. In parenchymal or lacunar tonsillitis destruction of the epithelium is effected. Ulceration has occurred and the entire tissue of the tonsil is involved by destructive suppuration. In this group the old terminology conforms with the microscopic picture.

Walcapfel presented microscopic evidence in support of his contention that the importance of thrombosis of veins has been greatly over-

emphasized Its occurrence is frequent, he stated, and may be found to a certain extent in any type of abscess Examination in serial section was made of the tonsils of patients who had been suffering from peritonsillar abscess and in several cases, from lacunar tonsillitis Waldapfel stressed the point that in spite of thrombosis and suppurative exudation into the vessels, all the patients have recovered and are now in good health

Riecke reported three cases in which careful histologic examination of the tonsillar and peritonsillar tissue was made He came to the conclusion that also in light and uncomplicated cases of angina, thrombophlebitis can occur in the peritonsillar tissue without causing manifest clinical symptoms or general sepsis Such cases can occur with or without abscesses in the peritonsillar tissue In one of the cases, peritonsillar abscesses had occurred, and complications in the kidneys and joints had been observed These could be traced to changes in the blood vessels The cases described show that a thrombophlebitis may occur which does not always produce threatening symptoms but which can be, if only temporarily, a cryptogenic source of infection which the organism, as a rule, can combat Unknown factors may come into play Why should inflammation progress in one case and not in another? The anatomic structure of the peritonsillar tissue appears to be not without significance Gaps may be caused by protruding crypts or cones of lymphatic cells, which favor the propagation of a primary infection in the tonsil Generally, however, the peritonsillar tissue is the first barrier, as can be seen by the increase and cicatricial change of the tissue It must be emphasized that staining of the elastic membrane is especially adapted to, and imperative in, the detection of these changes Changes of the vessels can thus be shown which otherwise cannot be found

Burchardt published a report of pathogenesis of sepsis after angina based on observations in eleven necropsies, in ten cases in which the patients were cured and in five cases (bordering on sepsis) in which especially enucleated tonsils were available In these five cases, she noticed perivascular infiltration The lumen of the vessels was free The lymph spaces were filled with cells and cocci All patients showed swelling of the regional lymphatic glands This perivascular infiltration was a common occurrence It always started in the tonsil or tonsillar bed, and could be followed, in the eleven necropsies, macroscopically and microscopically, to the large veins Here the lymph glands were always infiltrated and mostly matted together In six cases, contact infection was found between lymph nodules and the *venae faciales communes* or *jugulares*, in the lumen of which a suppurative thrombophlebitis was encountered immediately adjacent to the diseased lymph glands The walls of the vessels showed

inflammatory disintegration in all layers. The other five cases showed plainly adhesions between the infiltrated perivascular tissue and the walls of the vessels, partly to the bed of the tonsil. In one case a destructive inflammation could be observed reaching to the media whereas the intima was intact and the lumen empty. Uffenorde's theory is strengthened by the observation that the pathways of the tonsil are filled downward with cells, thrombotic masses, cocci, etc., especially since no proof could be adduced for a purely hematogenous process of propagation macroscopically or microscopically. Isolated lesions of the intima were never observed. The main point in postanginous complications seems to be the formation of a more or less pronounced phlegmon which propagates perivascularly. The lymph channels are undoubtedly involved. If the perivascular filtrates reach the blood vessels, they do so at any site, either near the original focus or deeper, affecting the *venae faciales communes* or *jugulares*. Whether or not a thrombophlebitis develops is of secondary importance so far as the genesis is concerned. The divergence of Fraenkel and Uffenorde can be explained in this manner.

COMPLICATIONS

Kleinert reported two cases of abscess of the lung following tonsillectomy. He called attention to the fact that the protective reflexes may be abolished under local as well as general anesthesia.

May, Thoburn and Rosenberger made a study of aspiration during tonsillectomy. With the use of iodized poppy seed oil 40 per cent, roentgenograms were taken at intervals during and after operation to determine the presence or absence of aspirated material. These investigations showed that the incidence of aspiration may be diminished by (a) the extreme Trendelenburg position, (b) constant and thorough removal of all pharyngeal secretions, (c) choice of types of anesthetic and operative technique which cause the appearance of a minimum amount of mucous secretions and hemorrhage, and (d) the use of a degree of anesthesia which at least in part preserves the irritability of the laryngeal and tracheal reflexes.

A study of the pathogenesis of pulmonary suppuration following tonsillectomy has convinced Harkavy that the greater amount of evidence is in favor of aspiration as the mode of production of suppuration of the lung following operations on the upper respiratory tract. In three of twenty-seven dogs that received, through the bronchoscope, 0.5 cc. of mixed cultures of bacteria recovered from the sputum of patients with abscesses of the lungs following tonsillectomy, abscesses with cavities developed, in one pulmonary suppuration developed, and a fifth presented evidence of a healed suppurative process in the lower lobe of the left lung, or 14.8 per cent of pulmonary suppuration. If results obtained

in dogs may be translated to the conditions occurring in man, it is suggested that following aspiration of infectious material from the upper respiratory tract, the course of events is as follows (1) pneumonitis, (2) necrosis and cavity formation, (3) healing or persistence of the primary abscess with the formation of secondary bronchiectasis

Alessandri and Visani assumed that it is almost universally accepted that many infections of the internal organs originate from primary inflammatory foci often located in the tonsils. That a casual relation actually exists between the tonsillar infection and the lesions existing in other organs is proved by these facts (1) the onset of the secondary infection following soon after the tonsillar infection, (2) the identity of the micro-organisms isolated from the tonsils with those found in the secondary focus, and (3) the marked improvement or absolute elimination of the secondary focus that frequently follows tonsillectomy. However, cases of suppurative pulmonary lesions arising in consequence of tonsillar infections are rare in the literature. The authors therefore reported five cases of gangrenous abscesses occurring in their medical clinic during the years 1922 to 1929 which seemed plainly secondary to a tonsillar inflammatory process. In these cases, neoarsphenamine effected a cure or considerable improvement. The infection may have reached the lung by any of these three routes (1) through the trachea and the bronchi, by inhalation of infective material from the tonsils, (2) by the blood stream, and (3) by the lymph nodes. The lymphatic vessels coming from the tonsils empty into the deep cervical lymph nodes, these are connected with the supraclavicular lymph nodes, which in turn connect with the retrosternal, the paratracheal and the tracheo-bronchial lymph nodes. It may happen that germs from the diseased tonsils pass through the lymphatic chain to the peribronchial nodes. These, suppurating, may evacuate into a bronchus and thus infect the lung. Fusiform bacilli, and especially spirochetes, are the casual agents of the disease and not the secondary invaders. Finally, the relation between oral spirochetes and pulmonary gangrene is shown by the demonstrated production in animals of gangrenous abscesses of the lung as a result of intrabronchial injections of material from the oral cavity containing the aforementioned organisms. Since arsenic has a marked therapeutic action on spirochetal infections, though it has none on ordinary infections due to pyogenic bacteria, it is intelligible why there are many authors who report cases of pulmonary gangrene in which a cure was effected by intravenous injections of neoarsphenamine.

From the consideration of thirteen cases reported within the last two years, in nine of which death occurred, Claus pointed to the danger of infection. In many cases it may be due to penetration of the infected tonsil and the still healthy muscular tissue with the same needle on injec-

tion for local anesthesia, thus creating a new focus of infection. Claus also considered operation in an acute stage of tonsillitis dangerous, and advised that a period of four weeks be allowed to pass before tonsillectomy. In case symptoms of general infection are noted, immediate tonsillar mediastinotomy should be done, together with injection of vaccine. Ligation of the veins should go hand in hand with drainage of the connective tissue. Two patients in whom these interventions were done were saved.

Uffenorde gave detailed description of three cases of sepsis which were caused by infected tonsils. He also mentioned similar cases which are reported in the literature. He stated that patients in whom phlegmons and abscesses do not disappear after a short time should be sent to a special clinic. This applies also to patients who have attacks of chills and continued high temperatures.

Nussbaum discussed pyemia following the anginas from the standpoint of pathogenesis, anatomy, diagnosis and treatment. He emphasized the fact that a streptococcus infection may spread beyond the tonsillar region to the contiguous tissues, causing peritonsillar and parapharyngeal suppuration. It may invade the blood vessels, giving rise to phlebitis and thrombosis. Bacteria directly invade the vascular system causing bacteremia with pyogenic emboli or a toxemia of a pure septic character. He recommended surgical treatment at the earliest possible moment, aiming at the tonsils themselves, so to say, infected hinterland by enucleation, exposure of the venous field, ligation, removing of clots and total excision of infected vessels in addition to drainage of pus collections.

According to Waldapfel, postanginous complications appear (1) as submucous complications, for example, peritonsillar abscess, (2) as disease of the lymph glands without injury of the wall of the pharynx, i. e., (*a*) a swelling or excessive enlargement or (*b*) an abscess with possible propagation toward the mediastinum, the base of the skull or the blood vessels, (3) as a direct penetration through the wall of the pharynx, namely, a parapharyngeal abscess with the possibilities mentioned under 2*b*, and (4) as a direct transmission of the microbes from the tonsil to the blood stream and their rapid distribution through the whole system. Viewed from the standpoint of therapy, cases of postanginous pyemia can be classified into two groups. Cases of the first group, with a tremendously rapid course, show no swelling of the neck and present the picture of a fulminating sepsis. It is entirely unknown whether a greater virulence of the microbe or a diminished resistance of the body, especially of the glandular apparatus, is to be taken into consideration. Cases of the second group are more localized, and show formation of abscess and swelling of the outer part of the neck. The

first group is characterized by an infection of the blood current, originating in the tonsil. The prognosis is bad, and the therapy thus far futile. For the second group, surgical intervention is indicated. The pharyngeal muscles and the pharyngeal fascia can be reached (1) from the anterior and posterior palatine arch or through the tonsil and (2) from the outside under the digastric muscle, by penetrating between the lower jaw and the pharyngeal wall. If the pharyngeal wall and the fascia have been penetrated by the inflammatory process the second route is the more successful one, because it meets the suppurative process and does not run after it and because it makes drainage possible at the lowest point, if intervention has come in time. This method with possibly a preliminary preventive mediastinotomy in the neck after Marschlik and preventive exclusion of the mediastinum of the thorax, is used in the Vienna clinic in the majority of cases. The resection of the thrombosed veins encountered in the operation is, naturally, always carried out. He also outlined the indications for mediastinotomy.

Schlittler stated that tonsillitis is generally considered a harmless disease from which the patient recovers in from five to seven days. However, occasionally serious complications arise which frequently result in the death of the patient. The author gave a detailed description of six cases. The reports show that serious complications are usually characterized by general symptoms rather than by local ones. If chills are observed on the third day and pneumonia or pyelitis is not suspected, the patient should be sent to a hospital. Chills and fever usually indicate septic pyemia. Other dangerous complications are pleuritis and bronchitis. The author also advised that the blood be examined because leukemia or agranulocytic angina sometimes complicates tonsillitis. At the best method of treatment, Schlittler advised surgical therapy. He asserted that chemotherapy and sero-immunology have not proved effective. Of twenty-eight patients with pyemia who were treated surgically, fourteen recovered. In consideration of the malignancy of the cases, the author regarded this as a favorable result. He emphasized that in order to assure the success of an operation, it should be made as early as possible. For persons who frequently suffer from tonsillitis, he advised prophylactic tonsillectomy.

Ide reported a case of cavernous sinus thrombosis and meningitis following tonsillectomy. Eight days after operation the patient began to complain of pain in the right ear, and later developed a general headache and proptosis of the right eye. The patient died with typical symptoms of cavernous sinus thrombosis and meningitis. Ide brought up the question as to whether the use of the LaForce instrument could have been an etiologic factor by its crashing effect on the veins. The question of the introduction of infection by the injection of a local anesthetic

was also considered. The advisability of early enucleation of the eye and drainage of the sinus was also considered as a possible means of preventing a fatal termination.

Blood cultures were taken by Rubin and his co-workers from seventy-eight selected patients following tonsillectomy. All patients showed evidences of recent infections of the throat. Positive blood cultures were not obtained in any case.

Goiny has not found any mention in the literature of a case of peritonsillar abscess caused by a foreign body. He observed such a case. In a woman, aged 38, a peritonsillar abscess was opened, with only temporary relief. Goiny had observed a yellow spot the size of a pin-head on the left tonsil, about 0.5 cm. from the palatine arch. A bristle, 9 mm. long, presented itself as Goiny was investigating the surroundings of the pus collection with a closed bayonet forceps. Foreign bodies are common occurrences in the valleculae, or in the faucial or lingual tonsils, but not peritonsillar abscesses. The author reported a case of Professor Seiffert. Seiffert saw a boy, aged 12 years, who suffered from peritonsillitis. A bristle from a tooth brush, 3 cm. in length, was removed. The author expressed the belief that in similar instances tonsillectomy might be considered if there is a well founded suspicion of the presence of a foreign body which does not show itself on the surface.

Fetterolf reported a very interesting case of infection by *Brucella melitensis* var. *abortus* complicating tonsillectomy. Four hours after operation the patient had a chill and a rise in temperature to 105 F. Blood studies showed that the patient was suffering from a blood stream infection by *Bacillus abortus*. This organism has long been known to produce infectious abortion in cattle. This type of infection is little known among otolaryngologists. Since children may contract this infection by drinking milk, Fetterolf emphasized the importance of considering this disease in children who are not cured by operative procedures in the tonsils, adenoids and sinuses, combined with proper hygienic and dietetic measures.

Miller reported a case of facial erysipelas following tonsillectomy. He reviewed the literature very comprehensively and reported the view of many observers. The general belief indicates that facial erysipelas frequently begins in the nose, nasopharynx and pharynx and spreads to the face. The fact that the facial lesions usually begin at the mucocutaneous margin of the mouth or nose substantiates this point of view. In Miller's case there existed a definite starting point for the infection in the region of the fossa following the removal of the faucial tonsils. The mucous membrane lesion spread through the nose to the face.

D'Amato reported four cases of chronic gastritis which gave the syndrome of gastric or duodenal ulcer. The differentiation between the two conditions was made by roentgen examination. *Staphylococcus*

aureus was recovered from the duodenal contents. The author proved that the condition was caused by tonsillar infection. In all cases, tonsillectomy gave excellent results. Cultures made from the tonsils gave *Staphylococcus aureus*. The author found by experiments in animals that this staphylococcus causes lesions on the mucosa of the stomach. The author expressed the belief that *Staphylococcus aureus*, acting for a long time on the walls of the stomach and duodenum, may produce ulcers. He also stated that in all gastric disturbances careful examination of the tonsils is indicated, and that all cases of chronic gastritis associated with chronic tonsillitis may be cured by tonsillectomy.

TREATMENT

Wagers conducted a study of 274 cases with reference to preoperative indication and postoperative results. Subsequent interviews and reports were obtained in eighty-four cases. No illness during one year or longer following operation was reported by thirty-seven patients. Illness of some description occurred in forty-seven. Sixty-three were definitely improved by operation and there was no improvement by operation in twenty-one.

Rackemann and Tobey reviewed 1,074 cases of bronchial asthma to determine the part played by focal infections and other disturbances in the nose, throat and teeth. In cases in which the tonsils and adenoids were infected, the percentage of patients "cured" and patients improved was not far different whether operations were performed or not. They found that the presence of foci bears little relation to the outcome of the asthma.

Thompson described an abortive treatment for peritonsillar inflammation in which he makes an incision early and inserts a rubber tube drain. He stated that resolution begins early, thus shortening the course of the disease and eliminating a great deal of the marked discomfort usually accompanying this disease.

Watt designed a new tonsil suture forceps which carried a suture through a round closed needle with no opening or slot to catch and tear the tissue.

Pearlman and Leshin devised a sharp guarded forceps for evacuating peritonsillar abscesses. The instrument is sharp-pointed, has sharpened edges and has a guard at a distance of 2.8 cm.

In a consideration of the surgical treatment of the tonsils, Tilley discussed the surgical aspects of developmental anomalies, tonsillar calculi and surgery and its relationship to the functions of the tonsils. He also discussed the tonsils as portals or carriers of infection in relation to such diseases as diphtheria, tuberculosis and chronic arthritis. He recommended radiotherapy as the method of choice in the treatment for

malignant disease of the tonsil. Among the various complications of tonsillectomy, hemorrhage and pulmonary sequelae were considered as the most important.

Trotter described the technic of nerve block in tonsillectomy. One hundred and twenty-six patients were operated on with satisfactory results. Quinine and urea hydrochloride is used in 0.5 per cent solution and 1 cc. is used in each tonsil. Epinephrine is used with the solution to secure vasoconstriction. This solution is used because it produces an anesthesia lasting several days and in some cases lasting as long as eight days. No sloughing or other untoward complications developed. One of the chief advantages of this method is the elimination of the usual postoperative discomfort in the throat.

Dutrow, in the consideration of the technic of tonsillectomy, advocated the dissection method as the one of choice. He recommended the submucous infiltration in preference to the deep injection. Bleeding can be satisfactorily controlled by clamping the descending palatine artery at the upper pole of the tonsil. He advised against the employment of nonsurgical substitutions such as electrocoagulation.

According to Poias, whose personal experience within the last few years covers more than 1,800 tonsillectomies, none of which had an unfavorable outcome, the tonsils are not of vital importance and they can be removed at any time without danger to the patient. He stated that the tendency toward sore throats is a sufficient indication for their surgical removal. The preferred type of operation in children is according to Sluder's method, in adults, tonsillectomy is advised with a blunt raspatory. For the purpose of checking venous bleeding, the use of a hemostatic drug is advised, given locally by insufflation, subcutaneously or by intravenous injection. Arterial hemorrhage is stopped by ligature around the vessel. For alleviating the pain caused by the wound, tampons soaked with antivenius are allowed to remain for a short while in the wound cavity, they have proved most efficacious. If the operation is done on account of sepsis or a suggestion of sepsis, a favorable result can be expected only if not more than one or two chills have occurred and if ligation of the jugular vein is done coincident with the tonsillectomy. Care should be taken that the ligature is made as far down as possible below the phlebotic portion of the vessel, in this case, only operation may save the patient's life. Otherwise, the prognosis is almost invariably serious.

The roentgen treatment for enlarged and infected tonsils is discussed by Nystrom. Seventy-four patients were treated in 1928. He usually treated the two outer fields, measuring about 5 by 6 cm., with one half of a Holzknecht erythema dose, copper filter of 0.5 mm., current of 2.5 ma., spark gap of 46 cm., and Coolidge tube. If necessary, the

irradiation was repeated after a six weeks' interval in exceptional cases three or four times. In the cases observed for from two to eight months, improvement was noted in thirty-two of the thirty-eight cases of chronic tonsillitis, decrease in the size of the tonsils was seen in two of four cases of simple hypertrophy of the tonsils in children, aged from 2 to 8. The author considered roentgen treatment in chronic tonsillitis best suited to patients with moderately enlarged tonsils with an uneven surface and crypts or pus plugs, in most of these patients noticeable improvement was attained, often complete cure. With tonsils greatly enlarged but not yet infected, and in simple hypertrophy of the tonsils, as seen especially in children, roentgen treatment is advised only when operative treatment is contraindicated.

Of forty-six patients with epithelioma of the tonsillar region who were given roentgen treatment by Coutard between 1920 and 1926, twelve (26 per cent) are still alive and free from cancer after an interval since the treatment of from eighteen months to seven years. Three of the twelve patients received supplementary treatment with radium, in one of the three patients a small cancerous lymph node was removed surgically. In three of the twelve patients palpable lymph nodes were absent, in five of them extensive enlargement of the lymph nodes was absent at the time of treatment. Four of them had had massive inoperable collections of enlarged lymph nodes extending from the angle of the jaw to the clavicle. Nine of the patients treated with success had had extensive lesions passing far beyond the tonsils and the palatine arches and infiltrating the velum, the uvula or the sulcus glossopharyngeus and the sulcus glossomaxillaris.

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Abstracts from Current Literature

Ear

OTOGENOUS SUBDURAL ABSCESS L RUEDI, *Monatschr f Ohrenh* **64** 3 (Jan) 1930

Ruedi reviews the literature and describes the clinical histories of five patients who came under his observation. The abscess resulted in all of these as complication of an otogenous intracranial abscess. In three patients the intracranial infection occurred through contact of the diseased bone and the dura mater. In one instance infection was carried into the subdural space through the blood. In three patients the subdural abscess was diffuse and of recent origin, whereas in two it was already circumscribed. The exudation into the subdural space occurs on the inner side of the dura. The arachnoidea is unusually resistant toward the exudate, and it is only after a long period of irrigation with pus that it becomes permeable. Organization of the subdural exudate is then effected and it becomes encapsulated through connective tissue and other adhesions. On the undersurface a partly exudative, partly hyperplastic, inflammation results. The brain, however, does not become involved. Clinically, in two patients the otogenous abscess was concurrent with marked symptoms of labyrinthitis, leptomeningitis and sepsis, in another patient, however, as a simple otogenous intracranial process without well defined symptoms. Differential diagnosis from a brain abscess is difficult. The meningeal symptoms, coincident with lack of pressure in the brain and chiefly the negative result of puncture of the brain, point to the otogenous abscess. Operative opening and evacuation of the abscess are the only hope for recovery in both cases.

EDITOR'S ABSTRACT

THE PATHOGENESIS OF MIDDLE EAR CHOLESTEATOMA STEURER, *Ztschr f Hals-, Nasen- u Ohrenh* **24** 402, 1929 (From the Transactions of the German Otolaryngological Congress)

The author shows sections illustrating invagination of the membrana tympani (Shrapnell's) without perforation, but with the ingrowth of epithelium which becomes sacculated, encloses a cyst and desquamates, i. e., a primary cholesteatoma. Some of the sections shown are from a new-born infant, in which Prussak's space was still filled with mesenchyme. He believes the factors to be a constitutional tendency to a local anatomic disposition, a squamous epithelial overgrowth and a local irritation, which may be an eczema of the external canal or an inflammation of the middle ear of such slight degree as to be unrecognized clinically.

"CLEARING" SPACES IN ROENTGEN PICTURES OF THE TEMPORAL BONE KRAINZ, *Ztschr f Hals-, Nasen- u Ohrenh* **24** 415, 1929 (From the Transactions of the German Otolaryngological Congress)

In acute inflammations two forms of change are found in roentgen pictures of the bone. The most common is veiling of the boundaries of the cells, associated with increasing defect apparently due to absorption of the cell walls, but with retention of the clearcut margins of the defect. If operation is performed in such cases, rarefaction is found to explain the roentgen observations. If the condition heals without operation, eventually the bone shadow returns to normal, but with changed structure. Less frequently one finds clearing spaces which are ill defined and which enlarge eccentrically, but with diffuse margins. If they heal without operation, the shadows return to normal, without any apparent structural change. The author undertook histologic studies to determine what caused this apparent

resorption, but found no changes in the bone that he could demonstrate. Histologically, by staining methods the "clear" regions appeared the same as bone which gave a good shadow, and the calcium content appeared the same. He says that since this is unexplained one should accept with caution the diagnostic import of such diffuse clear areas.

BACTERIOLOGY OF FEED ACUTE AND CHRONIC SUPPURATIVE OTITIS MEDIA
L. HOFMANN, Ztschr f Hals-, Nasen- u Ohrenh **24** 423 (Oct 1) 1929
(From the Transactions of the German Otolaryngological Congress)

Purulent in acute primary otitis in childhood is more frequent than is usually accepted. Such cases have a tendency to chronicity.

A bacteriologic investigation showed that obligate anaerobic saprophytes were responsible in only a few cases. The majority of organisms were aerobic saprophytes, mostly of the group of *Coryne pseudodiphtheria*, others were *Proteus communis*, *pyocyanus fluorescens* and *coli*.

In chronic otitis the *Coryne pseudodiphtheria* group played an important role, however, an equally important role was played by the obligate anaerobes. In the acute cases the saprophytes were recovered from the pus in the canal. The pus from the mastoid on which operation was performed showed only pyogenic bacteria, mostly streptococci.

Treatment with peroxide was disappointing. More success was obtained with astringents (formol, lysoform), and in cases in which *pyocyanus* was found, 5 or 10 per cent silver nitrate was used. Dry treatment with pulverized boric acid, after cleansing, was the most successful. Diphtheria antitoxin was without effect.

DEMONSTRATION OF RADICAL MASTOID OPERATION IN COLOR FILMS
W. UFFENORDE, Ztschr f Hals-, Nasen- u Ohrenh **24** 444, 1929 (From the Transactions of the German Otolaryngological Congress)

Only two primary colors are necessary for radical mastoid operation. By using behind one objective a blue-green and behind the other an orange-red, and then projecting the two films through corresponding filters so that they coincide on the screen, fairly natural colors are reproduced. The author shows his chiseling operation after Schwartze-Grunert, in cases of poor pneumatization he uses the Stacke method. He then shows his method of localized colorization before and behind the prominence of the horizontal canal, with the ensuing nystagmus. Third, he shows his own plastic method, consisting of a large flap of the canal made by a long incision along the upper posterior part, laid downward, and a quadrangular small one of the concha. A glass funnel is used to hold the flaps and to render removal of the tampon painless.

OTONEUROLOGIC SYMPTOMS IN TEMPOROSPHEOIDAL LOBE LESIONS
K. GRAHE, Ztschr f Hals-, Nasen- u Ohrenh **24** 498 (Oct 1) 1929 (From the Transactions of the German Otolaryngological Congress)

Twenty-one cases are analyzed in this report. The functional tests of hearing showed a slight loss for conversation on the side opposite the lesion, there was a slight loss of bone conduction for *a1* while the loss for *A* was greater, the low tone limit was qualitatively normal, while the upper limit showed a slight loss. There was a quantitative loss of hearing duration for low tones, especially on the side opposite the lesion. An exception was found in a case of tumor, which showed loss on the same side, with the greatest loss in the middle register.

The vestibular tests showed no characteristic spontaneous nystagmus or past-pointing, although these were present to some degree and in varying directions in some of the cases. Experimental nystagmus to the affected side was decreased in frequency, experimental past-pointing was more marked to the sick side. Spontaneous falling was more frequent to the well side, also, experimental falling was more marked to the opposite side.

EXPERIMENTAL INVESTIGATION OF VESTIBULAR INFLUENCE ON VASCULAR CHANGES DE CRINIS and S UNTERBERGER, *Ztschr f Hals-, Nasen- u Ohrenh* **24** 504 (Oct 1) 1929 (From the Transactions of the German Otolaryngological Congress)

Irritation of the vestibular apparatus causes a typical vascular reaction, shown by the increased volume of blood in certain parts of the body, in the authors' experiment, in the forearm

The same reaction takes place from either ear, and whether cold or hot water is used for calorization (This is contrary to Muck's theory that homolateral influence only is obtained) If the vestibular apparatus is impaired, no reaction obtains with either cold or heat applied to that side If both labyrinths are intact and are tested at the same time by double irrigation, the same vascular reaction occurs as with either side alone

EXPERIMENTAL INVESTIGATIONS OF THE QUESTION OF THE INFLUENCE OF DIABETES ON THE COURSE OF ACUTE OTITIS MEDIA HESSE, *Ztschr f Hals-, Nasen- u Ohrenh* **24** 512 (Oct 1) 1929 (From the Transactions of the German Otolaryngological Congress)

Some authors believe that anatomic considerations and local disposition of the tissues, regardless of the presence of diabetes, are the determining factors in the onset and course of infection, others take the view that diabetes provides the underlying cause The author removed the pancreas from a number of dogs, using normal dogs as controls A number of the dogs on which operations were performed died despite the administration of insulin, but a number survived and were used Cultures of hemolytic streptococci were injected into the tympanum Protocols of both the diabetic animals that survived long enough and the controls are given in detail Although the number of animals was few, the author concludes that so far as these evidenced, diabetes shows an unfavorable influence on the course of the infection It even appeared to be the underlying cause that permitted the onset of the infection

NYSTAGMUS IN RABBITS PRODUCED BY ELECTRIC STIMULATION OF THE BRAIN STEM A BLOHMKE, *Ztschr f Hals-, Nasen- u Ohrenh* **24** 520 (Oct 1) 1929 (From the Transactions of the German Otolaryngological Congress)

In a former work the author found that electric stimulation of the surface of the thalamus at the point where it merges with the anterior corpora quadrigemina produced nystagmus The reaction was not immediate, and was prolonged after the stimulation was discontinued, which indicated that the irritation was not applied directly to a nucleus, but operated through a neuron system The two questions for which answer was sought were What was the nature of the physiologic stimulation? Over what pathways is it carried from the thalamus to the nuclei of the eye muscles?

As to the first question, at present it can be said only that the thalamus (in rabbits) has some relation to the vestibular nuclei, only nystagmus of the labyrinthine type is evoked In regard to the pathways, the author followed the method of Lorente de Nó, who showed that the posterior longitudinal bundle was not the only pathway from the vestibular nuclei to the nuclei of the eye muscles, but that a considerable part was taken by the short fiber and cell system of the formatio reticularis, and that both components are influenced in this system, in fact, it may represent the supranuclear center governing the quick phase Section of the posterior longitudinal bundles did not stop the experimental nystagmus Section between the thalamic and the oculomotor centers did not stop it Sagittal section of the brain stem, cutting the cross fibers of the formatio reticularis, interrupted the reaction The author therefore argues the probability that the impulses go from the thalamus caudalward, are worked over in the formatio reticularis in the midbrain and pons and go forward to the oculomotor centers, also that the thalamus represents the most oralward of the neuron system for the production of

nystagmus, which neuron system extends through the medulla, pons and midbrain. In this system the higher functions lie in the oralward, the lower in the caudalward nuclei.

Lewis Chicago

Larynx

FURTHER HISTOLOGIC INVESTIGATIONS OF CHONDRIITIS AND PERICHONDRIITIS OF THE LARYNX, AND THE SIGNIFICANCE OF DYSPNEA IN THIS DISEASE
SEIFERTH, *Ztschr f Hals-, Nasen- u Ohrenh* **24** 555, 1929 (From the Transactions of the German Otolaryngological Congress)

The author describes in detail histologic pictures of inflammation and repair in cartilage. Usually repair is only partial and takes place through fibrous tissue, which may undergo some calcification. Cartilage but not bone may be melted down directly by pus cells without granulation tissue. His clinical observations are that the dyspnea of this disease is dangerous, leading to death unexpectedly, which he attributes to inhibition of the breathing center by irritation of the vagus rather than to carbon dioxide poisoning. For this reason and because of better healing, Seiferth urges early tracheotomy and cleaning out of the inflammatory areas. Conservative treatment is suitable only in cases of mild dyspnea. Healing under conservative treatment rarely occurs, and is not to be counted on.

Lewis, Chicago

Nose

RETROBULBAR OPTIC NEURITIS. FEIGENBAUM and SALZBERGER, *Klin Monatsbl f Augenh* **83** 657 (Oct 7) 1929

Feigenbaum and Salzberger reported on their study of twenty-four cases of retrobulbar optic neuritis, nineteen of the cases were of nasal sinus origin and in sixteen operations were performed. In the sixteen operative cases no gross or microscopic changes in the sinus membrane were found. The authors felt that a much higher percentage improved after operation and they advised opening the ethmoids and sphenoids.

In the discussion These mentioned that multiple sclerosis and toxic forms must be differentiated from the rhinogenous forms.

Meesmann reported experiences at the Berlin Charity Eye Clinic where in more than 100 cases seen in the last ten years, the classic outcome from endonasal treatment could be found only twice.

Scheerer felt that the further clearing up of the question of rhinogenous retrobulbar optic neuritis of nasal sinus origin is to be expected from a systematic ophthalmologic study of all cases of nasal sinus disease, cases of ambulatory neuritis being sought, and secondly a systematic follow-up of operative cases to determine the later appearance of multiple sclerosis.

Stendorff advised against delay in treatment. He felt that Herzog's so-called "Daueranemia" was of great help in the differential diagnosis of these cases.

Weill reported four cases of retrobulbar optic neuritis which healed without surgical intervention. He divided his cases into two classes, the first class consisting of those cases with a rapid loss of vision in young people, especially women, in whom the changes in the eyes were unilateral. In this group the recovery of vision usually occurred without any intervention. The retrobulbar optic neuritis is the first sign of multiple sclerosis. In the second class he presents the atypical cases, often bilateral, which develop at any age and are of slow progress. He felt that this is the group of nasal sinus origin in which surgical treatment is indicated.

In closing the discussion, Feigenbaum stated that from his pathologico-anatomic studies, he agreed with Herzog's theory of the direct spread of the infecting agents through the marrow spaces of the bone. Feigenbaum stated that he used Herzog's "Daueranemia," often with good therapeutic results, but he felt that operation should be performed in the severe cases.

CONCERNING RHINOGENOUS RETROBULBAR NEURITIS A CAR, Klin Monatsbl f Augenh **83** 825 (Dec) 1929

Cai, at a meeting of the Oto-Neuro-Ophthalmological Society held in Zagreb, reported that in 28,000 patients seen in the eye clinic at Zagreb, there were 12 cases of retrobulbar optic neuritis of nasal sinus origin.

Nasal sinus origin could be assigned to these cases for the following reasons (1) In such cases no other etiology could be found (2) The patients promptly improved after therapeutic intervention (3) One could find pathologic changes in the sinuses even though the clinical examination was negative.

HARRIS H. VAIL, Cincinnati

Miscellaneous

ABSCESS IN TEMPORAL LOBE, COMPLICATED BY MENINGITIS A REJTO, Monatschr f Ohrenh **64** 44 (Jan) 1930

Rejto was able to record the unusually complete history of a patient, aged 36, in whom the abscess formed during two weeks of acute exacerbation of chronic otitis media. Two operations were performed in which considerable quantities of pus were removed. Examination of the spinal fluid done every second day did not disclose bacteria. Symptoms of meningitis occurred, and ten days later the spinal fluid was seen to contain streptococci. The condition of the patient remained severe with a concurrent endocarditis. The temperature, however, gradually dropped, and recovery ensued.

RELATION BETWEEN TONSILS AND TRACHEOBRONCHIAL LYMPH NODES I HOFLER, Monatschr f Ohrenh **64** 50 (Jan) 1930

From a clinical and roentgenologic study of 174 children with hypertrophy of the tonsils necessitating operation and 100 children without enlargement, Hofler concludes that there is no connection between tuberculosis of the tracheobronchial lymph nodes and hypertrophy of the tonsils. He does not favor the theory propounded by many authors that enlargement or tuberculosis of the tracheobronchial lymph nodes with coincident hypertrophy of the pharyngeal tonsils is due to a descending infection of the lymphatic system. Hypertrophy of the pharyngeal tonsils is related to tuberculosis in children so far as inhibition of nasal breathing leads to a chronic bronchitis, which, according to statistics, is responsible in 95 per cent of all cases for concurrent infection by tuberculosis. Very few cases are known in which tuberculosis of the pharyngeal tonsils is primary to tuberculous lymph nodes. In four fifths of Hofler's cases hypertrophy of the pharyngeal tonsils was coincident with an enlargement of the cervical lymph nodes. Hypertrophy of the palatine tonsil was almost invariably attended by hypertrophy of the cervical lymph nodes. Enlargement of the cervical glands without hypertrophy of the tonsils may be referred to scrofula and lymphatic diathesis. If indications for adenotomy, tonsillectomy or tonsillotomy are given, these operations should be done, according to Hofler, in spite of a positive cutireaction for tuberculosis and a positive roentgen examination. The effect of the operation is invariably favorable on the pulmonary condition and may be continuous.

EDITOR'S ABSTRACT

DIAGNOSIS OF STRIDOR IN THE AIRWAYS FROM VARIOUS SOURCES VAN GILSE and KAISER, Ztschr f Hals-, Nasen- u Ohrenh **24** 530, 1929 (From the Transactions of the German Otolaryngological Congress)

The authors define stridor, for their purpose, as a noise due to obstruction anywhere in the airway, which can be heard by the unaided ear without direct contact with the patient's body. They except asthma and the asthmatic wheeze from this definition.

The various obstructions and their results are

1 Foreign body in the glottis Marked airhunger, voice markedly interfered with, sometimes inspiratory stridor, but often no difference between it and expiratory stridor, severe cough in beginning, auscultation of larger airways shows the sound loudest at larynx, bronchitic râles in both lungs equal, weakened breath sounds bilateral

2 Foreign body in subglottic space Voice weak but clear, airhunger according to size of obstruction, stridor more often inspiratory, cough even though not severe is persistent, heard loudest at larynx, and can be distinguished from voice sounds made at same time (body in larynx, auscultation sounds cannot be separated from voice if voice is heard at all), auscultation of lungs as in 1

3 Foreign body in trachea, but not near entrance to bronchi Voice unchanged, auscultation sounds loudest at site of obstruction but heard over all the airways, after initial cough, no cough, and airhunger only if obstructing body is large, lung sounds somewhat weak but bilaterally equal

4 Foreign body movable in trachea Airhunger variable, most when body is near glottis, loudest point of stridor changeable, while body is fixed in position cough subsides, at other times cough is paroxysmal, while the body obstructs one bronchus breathing may be weaker on one side than the other, a "flopping sound" may be noticed by the patient or heard on auscultation of larger airways

5 Foreign body fast in entrance of one bronchus, usually the right Unless the body is large enough to overlie both bronchi, or part of the trachea, airhunger is not great, stridor both ways, cough minimal, auscultation sound louder as one approaches (posteriorly) the midline, sometimes a sudden lessening of the auscultation noted over the airways compared to that over the foreign body, which is also usually of higher pitch Changeable sound here denotes some movability Weakened breath sound over the entire lung of the obstructed side if the foreign body does not reach the entrance of the upper lobe bronchus

6 In deep seated foreign body weakened breathing principally in the obstructed portion of lung, râles usually high pitched and localized

These signs are clearest, of course, in the beginning, later secretion complicates them, but seldom covers them up entirely, more often balls of secretion may suggest multiple foreign bodies The changeableness of the râles suggests their origin Auscultation should be done over the glottis and trachea, along the spine and outward over the larger airways

The authors also made a study by means of a diaphragm against the abdomen, which was connected with a kymograph and at the same time a nasal olive to conduct the respiratory sound, and report in detail the observations in a number of clinical cases They hope by this method to establish characteristic graphs for various conditions

TREATMENT FOR DYSPNEA IN ASTHMA BRONCHIALE ELSE LEVY, *Ztschr f Hals-, Nasen- u Ohrenh* 24 572, 1929 (From the Transactions of the German Otolaryngological Congress)

The author presents a sleeping bag which encloses the body like an oxygen tent, with a filter to keep out all allergic substances from the inspired air The bag opens and closes by a zipper contrivance The bag is easily transportable and gives plenty of room for movement

LEWY, Chicago

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

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SAMUEL SALINGER, M D, *President in the Chair*

INCIDENTAL MASTOIDITIS DR EDWIN MCGINNIS

Upper respiratory infection may be a very simple affair, evidencing itself as only a simple nasal cold of about a week's duration, or it may be more serious and its progress through the body may reach into many distant regions.

Mastoid infection may be the end-result of an acute coryza or tonsillitis, and if the infection is limited to one or both sides, its cure may be accomplished by a simple mastoidectomy. This is a happy end-result, because the patient's pain is usually relieved by the excision of the infected cells and the leukocytosis subsides, the temperature comes down to normal and the end-result is satisfactory.

Occasionally a patient is seen who has the classic symptoms of mastoiditis, and if operation is performed there is not the happy return to normal health. An early contact was obtained with such a patient who had had a mild case of tonsillitis, then a one-sided otitis media and later a mastoid involvement. Early myringotomy started the ear draining and the patient seemed better for a time, but soon he developed a rather high temperature, was dizzy and then had nausea and vomiting. A diagnosis of abscess of the brain was made. Later a cerebellar abscess was opened and drained on the side opposite to the infected ear and mastoid, and the supposition was that the abscess had its inception in the tonsillitis, and that the mastoiditis was incidental to the primary tonsillar infection.

This incidental infection of the mastoid is more clearly illustrated by the following case in the practice of Dr W W Wilson. Miss G G, aged 24, of Aurora, Ill, had an acute coryza, beginning about March 10, 1929. This was followed by pain in the left ear. Examination at that time by Dr Wilson showed tympanic congestion, but no bulging. The temperature was about 100 F, but the patient appeared more ill than the clinical observations indicated.

On March 12, under nitrous oxide anesthesia, a red and bulging drum was opened by Dr Wilson, and a thin greenish pus was emptied out of the middle ear. Short chain streptococci were found in this pus. From March 12 until March 28, she ran the course of an acute otitis media, with the temperature not going above 101 F, she seemed to be getting better, but on March 28, had a chill, and the temperature rose to 105 F. On this date she entered St Charles Hospital, and on April 2, her temperature reached 107.4 F.

There was moderate tenderness over the mastoid, and the ear was draining a serosanguineous fluid. Dr McGinnis examined her on March 30, and at that time her white cell count had dropped from 10,850, on March 29, to 6,500. On March 31, it dropped to 5,300. It was thought best to delay surgical intervention on the mastoid until after a blood transfusion, which was done on April 1. At the examination on March 30, he felt sure that she was suffering from a general sepsis which had its entrance through the nasal cells, because she had painful cervical glands on both sides and appeared more ill than the mastoid observations indicated. The question of lateral sinus infection and thrombosis was discussed at this time.

On April 2, Dr Wilson and Dr McGinnis did a simple mastoidectomy and as the wall of the sinus looked perfectly normal it was left alone. The patient made an uneventful recovery from the operation and the mastoid wound drained and healed in about four weeks.

From April 2 to 23, she ran a septic temperature, the maximum being 107.2 F, with numerous chills. On April 15, she complained of severe pain in the left iliac region. Heat and flexion of the left thigh on the abdomen relieved the pain. A palpable and tender mass could be outlined in the left iliac region. On April 23, under nitrous oxide anesthesia, a left muscle splitting incision was made, and a large amount of thin, bloody, purulent material was drained from this region. Bacteriologic examination of this discharge showed short chain streptococci. A rubber drainage tube was inserted and the patient made an uneventful recovery.

But this was not the end, for she continued to have fever up to 104 F, from April 23 to May 20.

On May 15, the patient developed a severe pain over the region of the right kidney, and mild chills, not similar to those of the onset. On May 21, an incision was made along the border of the lower rib postperitoneally, and the perirenal space was explored. No pus was found, but the patient commenced to improve following this procedure.

A second blood transfusion had been given on May 10. The temperature finally became normal about May 29, and had remained normal since.

The patient was discharged from the hospital on June 1, and made an uneventful recovery, without symptoms. She had gained about 30 pounds (13.6 Kg.).

Dr. McGinnis' first impression on examining this patient was that she had more than a mastoid infection, in other words, general sepsis, and he thought that the ear was not the only point of entrance, because the jugular vein on that side was not tender on palpation, and tender and painful glands were palpable on both sides of the neck. With this in mind, the lateral sinus and the jugular vein were not disturbed. He still felt that ligation of the jugular vein would have had very little helpful effect on the progress of the infection. He also wanted to eliminate shock as much as possible. He believed that the first blood transfusion was very helpful, in that it raised the white cells and carried her through the surgical intervention on the mastoid.

Dr. McGinnis' impression of this case was that the mastoiditis was just an incident in the general infection, and its elimination by operation was helpful in the cure.

He expressed his appreciation to Dr. W. W. Wilson for the chance of participating in this interesting and instructive case, in which they had the complete cooperation of the Brennecke Clinic and the St. Charles Hospital.

DISCUSSION

DR. C. W. HAWLEY: I volunteer the report of a case similar to the one reported by Dr. McGinnis.

A number of years ago at the Postgraduate Hospital I was consulted by a patient suffering from a neglected mastoid involvement on the right side. I performed an operation on the mastoid and for a few days the patient did well, but then an extensive abscess formed in the right shoulder. This abscess was opened and drained by the surgeon who referred the patient. A week later another abscess formed in the knee joint, which was also opened with a considerable discharge of pus. A prominent surgeon was called in consultation, and he said that everything possible had been done. The patient continued to lose weight and strength and I suggested giving vaccine, to which the others did not agree. Within a few days there was involvement of the ankle joint. An autogenous vaccine was then prepared, and 15 minims (0.92 cc.) was injected on each of three successive days. On the fourth day, the dose was reduced to 10 minims (0.6 cc.). At the end of two weeks, the abscesses had entirely healed and the one that threatened the ankle joint did not materialize.

I think that a patient suffering from any acute infection will stand larger doses of any medicine than he can stand in the course of a mild illness. Eighteen years ago I had an acute attack of facial erysipelas in which no vaccine was used, and two years later another, from which I recovered promptly following the use

of vaccine There was a recurrence in a few weeks, which also responded to vaccine therapy in 15 minim doses on two successive days

A patient with multiple abscesses in the neck also improved promptly under treatment with vaccine I believe that one should not be afraid to use liberal amounts in desperate cases

DR JOSEPH C BECK I think that the point for discussion is the recognition of an infected lateral sinus that looks normal The case Dr McGinnis has described is a multiple secondary infection, which I think would have recovered without operation

I recall a case at the University Hospital some years ago in which pneumococcic symptoms were very prominent, and this germ was thought to be responsible for the septic condition of the patient The jugular vein was not painful, and there was nothing to indicate that thrombosis was going on, but the picture was so suggestive of a thrombophlebitic type of mastoid that operation was determined on and the patient made a good recovery I think that from the standpoint of the otologist, knowing that the lateral sinus becomes infected easily, there is no harm in opening and treating it properly This is far better than to allow the patient to develop a septic endocarditis or a septic infarct in the lung

DR SAMUEL SALINGER I saw a case in consultation with Dr Sonnenschein The patient was a young woman who had had a mild otitis media, with a discharge for only two or three days Although there were no local signs of mastoiditis she developed chills and fever within five days, with a temperature of from 105 to 106 F and after eliminating all other possible foci it was decided to open the mastoid, which was found to be absolutely normal Exploration of the sinus showed that it also was normal Nevertheless, the jugular vein was ligated and the patient made a prompt recovery The case was evidently a direct blood stream infection by way of a small emissary vein, or else a mural thrombosis present was too fine to be detected As noted, the mastoid and the sinus were grossly normal

DR EDWIN MCGINNIS I do not think that the case was a lateral sinus thrombosis Some years ago I saw a case in which a young woman had an infection around the lower incisors and developed an abscess that extended underneath the periosteum of the inferior maxilla This area was opened and treated by gentle curettage, and cleared up nicely In two or three weeks she came in complaining of fever in the afternoon, and pain in the left groin Her temperature was 101 F She was placed in the hospital, and with the help of a urologist a left-sided perinephritic abscess was diagnosed An incision was made along the left lower border of the rib and a large amount of pus escaped This abscess could not be determined on percussion or palpation because it was so deeply situated

I have sometimes used vaccines in cases such as Dr Hawley described, but in the case reported it was a nonsuppurative variety of bacteria I agree that a mixed infection could exist without much change, because in sinus infections there can be marked involvement without much visible change, and the same might hold true of the mastoid

HYPERPYREXIA (FATAL) FOLLOWING TONSILLECTOMY DR SAMUEL J PEARLMAN and DR SAMUEL SALINGER

Following operations, major or minor, conducted under general anesthesia about the oral cavity or away from it, there has been noted what may be termed a syndrome of pallor and hyperpyrexia These symptoms come on a few hours after operative intervention and occasionally result fatally, within from twenty-four to forty-eight hours Postmortem examination, with few exceptions, has thrown surprisingly meager light on the cause of death The most common observations appear to be cerebral congestion and mild internal and external hydrocephalus As the cause of this syndrome is not known, there can be no rational preventive

therapy It would seem best not to operate on any person, particularly a child, with a temperature above 99.2 F

DISCUSSION

DR ROBERT SONNENSCHLIN The public and many physicians have come to believe that tonsillectomy is a simple and harmless procedure The fact that so many tonsillectomies are performed throughout the country, so often by general practitioners, with few serious sequelae, is no doubt the cause of this erroneous belief Many operators disregard the fact that serious if not fatal hemorrhages or other postoperative results such as infection of the throat and ears sometimes occur, but as long as they do not result fatally, physicians consider them as inconsequential results They likewise pay too little attention to possible distortion and stenosis of the pharynx, due to excessive scar formation following the removal of portions of the anterior pillar, the soft palate and uvula, to injury to the mucosa of the posterior pharyngeal wall in the removal of adenoids, etc One thing, however, has put the fear of God in them, and that is the unfortunate and occasional death which results from tonsillectomy

Dr Fetterolf at the last meeting of the American Laryngological Association, presented an interesting case report in which hyperpyrexia followed tonsillectomy and persisted for a number of weeks No etiologic factor was discovered for a long time, but *B abortus* was finally found This bacillus often infects cattle and produces abortion The patient shortly afterward recovered Dr Fetterolf said that the best treatment for this condition is the intravenous use of mercurochrome-220 soluble, and expressed the opinion that in all cases of hyperpyrexia lasting for a considerable time, without other cause, this bacillus should be sought

As demonstrated in this interesting paper, the exact cause of death is often not ascertainable even at autopsy Either the changes are microscopic, so that they are not detected at the time of postmortem examination, or they are not even discernible when histologic examinations are made Only recently Dr D J Davis stated before this society that in many of the tissues decided changes take place even a few moments after death, so that one can readily see that when postmortem examinations are delayed a number of hours or even longer, the changes in the tissues may be such that the exact pathologic process responsible for death cannot be diagnosed

It is impossible for me to throw any light on the unfortunate ending of some of these cases The references show that a number of theories have been advanced It is well known that acidosis occurs frequently after a general anesthesia in children and is often accompanied by very high temperature Fortunately, most of these patients respond very well to the administration of alkalis and carbohydrates, so that they usually recover rather promptly Should the acidosis however, be very severe, coma might ensue just as it does in cases of diabetes It seems to me that the theory of death based on the unstable nervous system in small children, together with some disturbance in the heat regulating center, may account for some of these fatalities No blame can be attached to the operator if all reasonable precautions have been taken, such as a careful examination of the urine, the heart, the thymic region, etc, but one must ever bear in mind the possibility of grave postoperative results Both the surgeon and the layman should recognize the fact that there is danger connected with any operation, and the mere fact that a certain type of operation is often performed does not obviate the possibility of serious and wholly unexpected results Since there are inherent dangers in all operations, none should be advised unless a thorough examination and a definite history give clear indications for surgical intervention Furthermore, all possible care in the performance of the operation and in the postoperative course is imperative Then and then only can consciences be clear when these inexplicable and unfortunate things are noted after a carefully performed operation

The essayists have rendered a great service in bringing attention to this series of cases

DR J HOLINGER In a recent number of the *Zeitschrift für Ohren, Nasen und Halskrankheiten* a number of similar cases were recorded. When death occurred, the parts around the tonsils were carefully dissected and it was found that in a certain proportion of the cases the large veins from the tonsils were thrombosed with septic thrombi. The thrombophlebitis progressed along the large veins to the cavernous sinus at the base of the brain. The connection from the tonsils to the sinus is short, and a thrombophlebitis in these regions is rather difficult to find. Recently, reports of ligation of the veins have been published.

I do not know whether after tonsillectomy the cavity should be swabbed with a strong antiseptic. I like to use peroxide, which has the double advantage of stopping the hemorrhage and of being a strong antiseptic that does not injure the tissues.

DR ROBERT SONNENSCHNEIN I think that the explanation suggested by Dr Holinger would not answer in these cases, for the first patient died within sixteen hours after operation and no infection could produce a septicemia and cause death in that time. In the *Monatsschrift für Ohrenheilkunde und Laryngo-Rhinologie*, Waldapfel, who read a paper before the American Academy of Ophthalmology and Otolaryngology, in 1928, had an article in which he stated that dissections have shown that probably in many cases of tonsillectomy there is some thrombosis in the veins along the tonsils, but this did not cause pyemia.

DR GEORGE W BOOT It is a well known fact that there is such a thing as heat stroke, but often nothing can be found post mortem to explain it. There is a septic temperature due to thrombosis of the peritonsillar plexus following tonsillectomy, and I have seen such a case at the Children's Memorial Hospital that persisted for several weeks, but the patient finally recovered.

Has anyone seen acidosis following the use of nitrous oxide as an anesthetic?

DR OTTO STEIN It was apparent that the tonsillectomy had nothing to do with the hyperpyrexia, for the condition is known to occur following various surgical operations anywhere in the body, particularly in cases of cleft palate in which postmortem examination has shown extreme hyperemia of the brain. I recall a case which followed a hypophyseal operation under local anesthesia. This was one of a series of eighteen cases, and resulted in death from hyperpyrexia within two days. The operation was very rapid and uncovered an enormous cyst. Through some mistake the incision was enlarged very rapidly, and a large amount of straw-colored fluid escaped. No attempt was made to enter the cyst, but within a few hours the patient developed a high temperature, which reached 107.5 F before death occurred two days later. When seen on the evening of the operation, a strong odor of acetone could be detected on his breath. I think that possibly the fatal termination was due to the sudden release of pressure at the base of the brain, in the neighborhood of the heat-regulating mechanism.

DR JOHN A CAVANAUGH I saw a case with Dr Tydings in a young woman in whom hemorrhage developed following operation. She was taken to the Chicago Eye, Ear, Nose and Throat Hospital, and within six hours developed a temperature of 105 F, which persisted for two days and was accompanied by delirium. After the second day the temperature dropped to almost normal and remained there for twenty-four hours, when it rose to 104.5 F, where it stayed for about thirty-six hours and then subsided. Nothing was ever found to explain the cause. The patient recovered.

DR J GORDON WILSON I have seen several cases of hyperpyrexia, but none associated with removal of the tonsils. Hyperpyrexia is divided into two groups: one coming on immediately after an operation and the other developing after some days. The first is due to disturbance of the heat-regulating mechanism, the delicate nervous mechanism which keeps warm-blooded animals at an even temperature. In such cases the operation, for an unknown cause, throws the mechanism out of action, comparable in some way to "shock," and the temperature rises abnormally. In some cases, on postmortem examination hyperemia of the brain has been disclosed, but in others no postmortem change could be demonstrated.

In the second group there is an abrupt rise in temperature later, it may be on the second or third day after the operation. This, I believe, is due to some toxic absorption.

In children, following an operation on the tonsils I have seen a rise in temperature which may be abnormally high, but in no case have I seen anything approximating a hyperpyrexia or a fatal result.

DR HOWARD C BAILLINGER. In order to determine the question of bacteremia following tonsillectomy at the Sprague Institute of the Children's Memorial Hospital, a series of seventy-three blood cultures was taken by Dr Rubin during and after the operation on the tonsils to see whether fever following tonsillectomy could be explained through bacteremia. In all seventy-three cases, the cultures proved negative. I think that it is apparent that a bacteremia does not have much to do with these cases, but due allowance should be made because of the difficulty of determining whether a bacteremia is present, especially a transitory bacteremia.

DR NOAH SCHOOLMAN. I think that the adenoidectomy is probably as frequently implicated in these rare accidents as the operation on the tonsils. The vault of the pharynx is attached to the most vulnerable part of the base of the skull involved in this operation. On its cerebral aspect lie the medulla and the pons with the cranial nerves emerging from them. It is also in close proximity to the hypophysis. In intra-uterine life this portion of the basic cranium, the pars basilaris, exists as a separate mass of embryonic osseous structure with loose cartilaginous attachment to the rest of the base of the skull. These conditions may persist indefinitely into infancy and childhood. Adenoidectomy is usually performed with massive instruments which exert considerable force on this portion of the cranium which may, under unusual predisposing circumstances, cause hemorrhage or other injury to the superimposed midbrain.

I call attention to the interesting work of Professor Levy of Berlin regarding the vascular and lymphatic relations of the adenoid and the hypophysis and the pathologic implications of such relations under some circumstances.

DR ARTHUR M CORWIN. Is there any clinical record of the treatment for hyperpyrexia in these cases?

DR JOSEPH C BECK. Referring to acidosis following the administration of nitrous oxide anesthesia, I shall cite a case in which this anesthetic was given to a patient on whom the physicians started to operate under local anesthesia. The patient was a woman, aged 60, who had difficulty in breathing because of a central thyroid gland. A local infiltration was performed with apothesine, the object being to do a tracheotomy to give room for breathing. After completing the infiltration and dissecting the gland freely, great difficulty was encountered in keeping the patient quiet, so nitrous oxide gas was given in order to expose the trachea. The patient breathed easily immediately, but promptly went into a condition of acidosis. Her breath was very strong, she vomited, developed all the symptoms of acidosis and died within a few hours. There were no symptoms referable to the lungs, and a postmortem examination could not be secured.

In the investigation of the condition of hyperpyrexia I hoped to hear something of the work of Vaughan, who did a great deal in the way of producing high temperatures by giving foreign proteins.

DR SAMUEL J PEARLMAN. The object of the paper was to call attention to a syndrome of high temperature, pallor and occasional death. Because of the few cases reported, it was thought to be an extremely rare condition, but judging by the cases cited in the discussion, it is evidently more common than I had believed.

The fact that thrombi are found in the tonsillar fossa following tonsillectomy had nothing to do with the condition, but minor operations under general and sometimes under local anesthesia do produce this syndrome. There is no agreement as to the cause, but I think that the suggestion of Dr Wilson, that there was some connection with the heat-regulating mechanism, is to the point. The pallor is that associated with bulbar involvement. The patients with sepsis following

tonsillectomy usually survive for a number of days, and postmortem observations often indicate the cause of death and show, for instance thrombi in the jugular vein. As to split proteins causing the condition, I think that no one can say.

The lesson to be learned from these cases is that no operation should be undertaken unless there is a very good reason for it.

FOREIGN BODY IN THE LUNG DR JOHN A CAVANAUGH

This case was presented because of the unusual location of a foreign body in the lung.

Mrs E S aged 52 was referred because of a probable foreign body in the right lung, with the following history. While eating chicken at dinner the night before she suddenly choked, gasped for breath and ran to the back porch seeking air, she stuck her finger into her throat, something gave way and she gradually regained breath and felt better. There was very little coughing but a slight pain developed in the right side of the chest. Convinced now that a foreign body was there she assumed various positions, almost standing on her head forward, hoping gravity might assist in getting rid of it. Finally a neighborhood physician was consulted who assured her that anxiety was needless, but not being satisfied she sought the advice of a throat specialist who examined her throat and also declared that there was nothing wrong. She returned home still feeling the discomfort, went to bed and passed a restless night, feeling a tightness in the chest she began to wheeze and feared that she had asthma. The following morning another physician was consulted who thought that a foreign body might be present in the lung. A roentgenogram was made which showed a rather long thin shadow in the right side of the chest and she was referred to Dr Cavanaugh who saw her about 2 p. m. There were distinct râles over the right lung. The temperature was 99 F, the pulse rate, 100. Respirations numbered 24. The right vocal cord had on its upper surface a submucous hemorrhagic spot in its middle third. The balance of the larynx was a dusky red and the arytenoids were slightly edematous. He advised going to the hospital at once, but met with considerable opposition from the patient and her daughter. Mrs E S cited a case reported in the newspaper in which a patient coughed up a screw after being held up by the feet and wanted to know if he could not hang her up by the feet and shake it out. After much controversy she went to St Luke's Hospital. One-fourth grain (0.0162 Gm) of morphine sulphate and $\frac{1}{200}$ grain (0.00032 Gm) of scopolamine hydrobromide were given hypodermatically, applications of 10 per cent cocaine were made to the larynx and an application of 5 per cent cocaine below the glottis. Dr Cavanaugh introduced a 7 mm Brunning tube and when the right main bronchus was reached he could see a somewhat whitish mass on the anterior wall. Passing into the right bronchus he could see the foreign body lodged in the mouth of the middle lobe and with a Jackson forcep he grasped the protruding portion and removed it. The size necessitated the removal of the tube at the same time. When the glottis was reached he turned the foreign body so the long axis would be with the long axis of the glottis and it slipped through without traumatizing. The object was a chicken bone 2 mm long, 13.5 mm thick at one end and 10 mm at the other. The patient was removed to a croup tent where she remained for three days making an uneventful recovery. When Dr Cavanaugh saw her at the office a week later a little redness of the cords remained, otherwise they were normal and the chest showed negative observations.

DISCUSSION

DR EDWIN MCGINNIS I saw a case in which a child coughed up a screw. Tucker told me that only about 2 per cent of the foreign objects in the finer bronchi were coughed up. I congratulate Dr Cavanaugh on getting such a large object out between the cords without injury to them. Recently, a dentist, while attempting to fit a five tooth bridge to some prepared teeth let it slip, and it landed in the right bronchus. It took a good deal of patience to slide it out between the vocal cords without injury to them.

DR GEORGE W BOOT In the last three cases in which I used bronchoscopic treatment, the patient coughed up the foreign body before I could reach it. I consider it a very serious matter to take out a large foreign body between the cords, particularly if it is larger than the tube. In a case seen recently in which a child had swallowed half a peanut kernel, the patient died before I could perform a tracheotomy.

FOREIGN BODY (DEPOSIT OF BARIUM) IN ANTRUM DR AUSTIN A HAYDEN

The patient was a school teacher who had been operated on for the removal of gallstones. Her nose and throat were examined before operation and were found to be normal. A few days after the cholelithotomy she complained of pain in the region of the right antrum. A roentgenogram revealed the presence of a foreign body. Investigation showed this to be a mass of barium that had lodged in the antrum when the patient vomited following a barium meal during the examination of the gastro-intestinal tract.

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOTOLOGY AND LARYNGOLOGY

H P SCHENCK M D, *Reporter*

Dec 18, 1929

GEORGE M COATES, M D, *Chairman*

REPORT OF A CASE OF SINUS THROMBOSIS PRESENTING SOME INTERESTING FEATURES DR BENJAMIN D PARISH

Seven weeks after exposure to scarlet fever and a protective inoculation of antiscarlatinal serum, a boy, aged 10 years, developed earache with a temperature of 104 F. An incision of the bulging left drumhead liberated bloody serum, but his condition was no better on the following day and operation revealed a hemorrhagic mastoid, the general appearance of the bone being that of an acute osteomyelitis. A pure culture of *Streptococcus hemolyticus* was obtained from the antrum.

After operation, the temperature dropped to 100 F, but within the next two days rose to 105 and 106 F. Blood cultures were negative. The internal jugular was ligated, and through the original incision the inner table of mastoid over the sigmoid sinus was removed, the sinus was found bathed in pus. The wall of the sinus was very dark and was firm to the touch. The clot was removed from the sinus.

A stormy period followed, with the temperature ranging from 105 to 100 F. Five days after operation the patient received 250 cc of his father's blood without improvement. That night the father developed a streptococcic tonsillitis. One week after the sigmoid sinus was opened, the patient had the first chill and following the administration of 20 cc of 1 per cent solution of mercurochrome-220 soluble, the temperature rose to 107.2 F. Eleven days after the first operation, the blood first showed a positive culture of *Streptococcus hemolyticus*. The following day, as skin tests were negative, an intravenous dose of antistreptococcus serum was given. Less than 5 cc of serum, however, produced anaphylactic shock, and the patient hovered between life and death for twenty minutes, but revived under large doses of epinephrine and general stimulation.

The administration of mercury succinimide intravenously on the thirteenth day was followed by a chill and a rise in temperature to 108.6 F. On the fifteenth day, the father having sufficiently recovered from his tonsillitis, another transfusion of 300 cc was given. Marked improvement followed. Three more transfusions

were given at intervals of two days, and a second dose of mercury succinimide was administered. Improvement was rapid from this time on, and the patient was discharged from the hospital with the wound healed one month and twelve days after admission.

Dr Parish concluded that no chemical agents can be relied on to render an infected blood stream sterile, and that the real weapons of attack are repeated blood transfusions, supported by spirits of frumenti and arsenic, and that if it is possible to obtain the blood of a donor just recovering from the same type of infection, the surgeon may consider himself especially lucky.

DISCUSSION

DR ALEXANDER RANDALL. The influence of the father's blood in this case is of extreme interest. While the matter of transfusion is frequently indicated, a suitable donor may not be available. In such instances the intravenous use of saline solution is of value. Elimination by the skin and kidneys lessens the septic condition of the patient. Blood from a donor in the recovering stage is certainly of great aid.

DR CURTIS C EVES. With temperatures of 107.4 and 108.8 F, I think that Dr Parish should be congratulated in getting this patient well. The blood of a patient who has recovered from sinus thrombosis should be valuable for some time. However, there are many types of streptococci and the difficulty would consist in securing donors with the same type of streptococcic infection as the patient.

DR ROBERT J HUNTER. Dr Igleton has advised taking cultures in desperate cases and vaccinating donors. Of course this takes time but as the transfusions go on the donor is developing his immunity to higher levels.

DR GEORGE M COATES. Dr Igleton vaccinates donors from time to time against various organisms to maintain their immunity so that they are available as occasion arises. I performed a sinus thrombosis operation on a mother, and eight years later did the same operation on the daughter. The father's blood was not of value but one transfusion of the mother's blood ended the matter.

DR JAMES A BABBITT. One patient of Dr Butler recovered because of the use of mercurochrome under Dr Piper's direction.

DR BENJAMIN D PARISH. I was interested in bringing out discussion regarding chemical agents of value in infections of the blood stream. We used succinimide of mercury because in one of Dr Fielding Lewis' cases recovery was felt to be due to this agent.

SYPHILIS OF THE TEMPORAL BONE, WITH ACUTE PNEUMOCOCCIC MENINGITIS REPORT OF A CASE. DR ROBERT J HUNTER and DR WILLIAM P BELK

In January, 1927, a man was picked up on the street unconscious and was brought to the hospital with no marks of identification. It was evident that he had a purulent meningitis with profuse purulent otitis. On brief examination, it appeared that his ears were the portal of entry. Examination of the spinal fluid showed 3,550 cells, 100 per cent polymorphonuclears, with a micrococcus in the smear. This, at once, made the case appear hopeless. But in view of the recent work of Dr Kolmer and Dr Eagleton, we determined to give the patient what small chances there were. We did a radical mastoid operation on the left ear, which appeared to be the worst, and having found no definite leads to the brain, after exenteration, we turned to the right ear, on which we performed a simple mastoid operation, having found that there was relatively no involvement, the inflammation being confined chiefly to the region of the middle ear. We then trephined over the posterior horn of the left lateral ventricle, inserted a needle into the cisterna magna and washed through and through. Another needle was inserted into the lumbar spine and lavage from this point to the cisterna magna was carried out. Physiologic solution of sodium chloride was used.

The patient improved wonderfully after the operation. Within twelve hours he was conscious and well oriented. We got in touch with his physician and found that he had been under treatment for syphilis. The patient did not take arsphenamine well, he had been taking bismuth. The history of the case was not available, but his physician had suspected an intracranial condition and had ordered him to go to the hospital. He was on his way there when he fell over on the street.

We performed lavage of the cerebrospinal system the second time and injected the formalin solution into the spinal canal. The patient did not improve with the second injection. Within forty-eight hours, we had a report that the gram-positive *micrococcus* first observed on the day of admission was the pneumococcus. The patient died on the same day.

Autopsy revealed a frank purulent meningitis, with thick yellow pus, covering the base of the brain. The appearance of the petrous bone was unusual. There was a bilateral, more or less symmetrical, involvement of the apex of each bone. The dura was gone and both bones were eroded and had a moth-eaten appearance. It was evident that this was the source of the infection and not from the usual mastoid area.

The bones were taken for sectioning, the Nagel method being used. This takes a year and with interruptions has taken us two years. The last sections have just come through. The slides are exceptionally fine and repay us for the time spent.

(Dr. Hunter then exhibited a number of sections of the temporal bone and brain, demonstrating the anatomy of the internal ear, the chronic lesions in the syphilitic areas and the acute invasion with the pneumococcus.)

DISCUSSION

DR. ALEXANDER RANDALL. Such work is carried out in few countries, and it is gratifying to see such work and such technical care in working out these delicate structures. The Mutter Museum is fortunate in having a great collection of such studies.

DR. BENJAMIN PARISH. We had a case seven months ago which was probably syphilitic, as this was, but we failed to obtain an autopsy. On admission the ears were running and there was evident meningitis. The Wassermann reaction was 4 plus. We operated, but the patient died in three days. The symptoms may have been due to cerebral syphilis or to brain abscess, independent of syphilis, and to the abscess of the ear. I do not know whether we were justified in looking for an abscess. Should we have regarded it as syphilis?

DR. STEPHEN WEEDER. I reported a case of meningitis. A playmate of the patient developed evident meningitis, with 3,000 cells in the spinal fluid. The recovery was complete in a week.

DR. ALEXANDER RANDALL. I always question about the pulse rate because in brain abscess few cases fail to show a decided slowing of the pulse. This is the most characteristic feature of brain abscess. The rate is slow even if meningitis is also present. I have seen thirty or forty such cases.

DR. EDWARD B. GLEASON. The number of cells is not of great consequence if no bacteria are present. Polymorphonuclear cells indicate an active process while lymphocytes indicate a more chronic process.

DR. ROBERT J. HUNTER. This patient showed no symptoms of brain abscess and no slowing of the pulse. The blood pressure was 140 systolic and 80 diastolic. A patient with a 4 plus Wassermann may also have an additional infection. One patient was referred for a differential diagnosis between lateral sinus thrombosis and cavernous sinus thrombosis. Erosion in the nose and blistering of the mucous membrane indicated syphilis and the Wassermann reaction proved to be 4 plus. The entire process subsided under antisiphilitic treatment. In another case it was thought that the facial palsy present was due to syphilis but the ear was found to be involved and following a mastoid operation the facial palsy cleared.

up The question that Dr Gleason brings up is important The decision only too often rests on the bacteriologic reports Often several days elapse before the report is obtained and valuable time is lost In one case showing 2,000 cells, successive taps were done and no organisms found The patient got well with no other treatment than the spinal tapping

ATRESIA OF LARYNX A PROBLEM IN TREATMENT DR LOUIS H CLERT and DR EDMOND L AUCOIN

A man, aged 32, was struck across the front of the neck by a stick of wood, thrown by a saw, and knocked unconscious An emergency tracheotomy was necessary the same day At no time was it possible to decannulate, and the laryngeal airway became progressively smaller, ultimately closing

On admission to the Chevalier Jackson Clinic, fourteen months after the injury, it was found that the tracheotomy cannula had been changed only once since its introduction No air passed through the normal passages and the airway was completely closed There were distortion and asymmetry of the larynx A low tracheotomy was performed, but direct laryngoscopy revealed no laryngeal lumen, and a diagnosis of atresia of the larynx due to cicatricial changes secondary to perichondritis was made The larynx was probably fractured at the time of injury

Laryngostomy was performed one month after admission, and a new airway was established from below upward, keeping close to the right ala of the thyroid which was apparently the only remaining portion of the laryngeal cartilages A gauze pack was introduced The new laryngeal lumen epithelialized slowly but was complete in two months and a rubber laryngostomy apparatus was then introduced The size of the apparatus was slowly increased Six months after operation, the apparatus was removed for a test period and within a few days the lumen had contracted to one-fourth its original size Similar results followed successive test periods, and it was concluded that the difficulty lay in the lack of support of the soft tissues of the larynx, since only a portion of the right wing of the thyroid cartilage and some small masses of cartilage in the region of the cricoid were found at operation

It was planned to give lateral fixation first and then to bridge the gap between this by implants placed anteriorly and posteriorly Two portions of rib, 8 cm in length, were removed and one of these was placed in the soft tissues on each side of the neck alongside of and corresponding to the axis of the trachea and larynx At the lower ends the grafts were in close proximity to the trachea, at the upper ends, the interval between them was somewhat greater The airway was not entered Healing took place by first intention

The lateral splints have now been in place for six months Definite support is given to the lateral walls but the anterior and posterior walls continue to encroach on the laryngeal lumen It is planned to insert several portions of costal cartilage beneath the mucous membrane both anteriorly and posteriorly, the rib transplants being used as supports This should provide a more or less rigid box for the larynx so that the patient will be able to resume breathing through the normal passages

DISCUSSION

DR JAMES A BABBITT Exactly what portions of bone were used? What prospect has the patient of a voice?

DR EDMOND L AUCOIN The solid, bony portion was used with the periosteum intact The patient has a buccal voice, there is no laryngeal voice

FRONTAL SINUSITIS COMPLICATED BY OSTEOMYELITIS AND EXTRADURAL ABSCESS DR KARL M HOUSER

One week after a slight cold, from which he had apparently recovered, a university student, aged 17, was admitted to the hospital because of severe frontal

pain, malaise, nausea and vomiting. There was marked prostration together with a temperature of 103.4 F and a leukocyte count of 21,000, 84 per cent of which were polymorphonuclears. Tenderness was elicited over both frontal sinuses and they were dark to transillumination. The antrums were negative. The middle turbinates and nasal mucous membrane were slightly swollen and congested. Streams of pus were present at the posterior ends of the middle meati and also in the sphenoidal recesses. Blood cultures were negative.

The patient became steadily worse in spite of general and intranasal medication. The swelling over the right frontal sinus became more marked, inflammation of the right eye, sufficient to cause some fixation of the bulb, developed, together with chemosis. The roentgenologist reported clouding of the left frontal sinus and haziness of the right, clouding of the left antrum, clouding of the right ethmoids and hazy sphenoids. The symptoms were more marked on the right so that, a week after admission, the anterior third of the right middle turbinate was removed, several ethmoid cells in the region of the nasofrontal duct were opened and the sinus was probed. No improvement followed.

On the following day, the leukocytes having risen to 28,000, and the symptoms becoming worse, a small button of bone was removed from the lower inner portion of the anterior wall of each frontal sinus. Both sinuses were found to be filled with thick pus. There was no bony involvement in the right sinus but bare bone was encountered in the superior portion of the left sinus. A subperiosteal abscess to the right of the midline and 3 cm above the supra-orbital ridge was evacuated.

Improvement in the external condition of the eye followed this operation, and the patient was more comfortable but as fluctuant areas developed in the right frontal and right frontotemporal regions, it was deemed advisable to make three incisions, one about 6.5 cm above the right supra-orbital ridge near the midline, another on a line between this incision and the tip of the ear, and the last, about 2.5 cm above the right ear. An abundance of pus was obtained and the periosteum found to be elevated. The three wounds were connected by subgaleal tunneling and drained by rubber tubes.

Vomiting, headache, slow respiration and pulse rate, along with bilateral choking of the optic disks forced further procedures. Dr Francis C. Grant removed the anterior wall of both frontal sinuses, finding definite evidence of extensive osteomyelitis. When the posterior wall of the right frontal sinus was removed, pus immediately welled into the wound. When this opening was widened, the dura over the right frontal lobe was found to be covered with granulation tissue and occasional pockets of pus. The diseased bone was removed and then the dura was exposed behind the left frontal sinus without evidence of disease. The wound was packed wide open and convalescence began at once. Optic disk choking disappeared in a week, and the patient was discharged from the hospital two months after admission. No evidence of abscess has developed during the seven months since discharge and the patient is leading an apparently normal existence.

DISCUSSION

DR FRANCIS C. GRANT. The question of intradural abscess arose in this case and we decided to explore. It was necessary to incise the abscesses and drain them. After removing the bone, extradural abscesses were exposed. Did the patient have subdural abscesses? We were not sure and feared going through the dura in an infected field and infecting an uninfected brain. Therefore, we went no further. The symptoms of intracranial pressure cleared up and, fortunately, we had to go no further. I am not happy about this patient yet, and will not be until a year has passed. A silent area may still be involved but the patient is gaining weight and appears well.

I have seen four such cases during the past year. Two cases followed frontal sinusitis and both patients died. No choked disk was present but a large abscess of the frontal lobe was found in each instance. Another case, following frontal sinusitis with osteomyelitis, in which there was a frontal abscess, was drained

and packed and the patient recovered. The question of proper treatment for osteomyelitis of the skull is one of radical versus conservative treatment. Emissary veins may cause extension.

In Blair's review of these cases, he reports six of his own, in which the patients were treated conservatively, with no curetting and no dissemination of infection, and he feels that this is the proper treatment. In thirty-seven cases in which radical operation was performed, twenty-five patients died and twelve are living. Of nine patients, conservatively treated, six are living and three died. Death is usually due to brain abscess or meningitis.

Chemotherapy, vaccines and intravenous therapy have their champions. We were conservative in this case, draining only as pus appeared. We never made large incisions and never curetted. The patient probably eventually developed an immunity. This probably limited the infection. I feel that conservative treatment is best—removal of the bone and exposure of the abscess. Do not go through the dura until you have to. Wait ten days and then you can tell if there is a brain abscess or not. Allow the bone to fenestrate.

DR GEORGE B WOOD. One of my patients with frontal sinusitis, frontal osteomyelitis and brain abscess on whom Dr Grant operated, recovered. The reason why so many of these patients die is because the disease is so close to the brain, which is a vital organ. These patients tend to get well just as much as those with osteomyelitis anywhere else in the body, but meanwhile meningitis or brain abscess may appear. The important point in the cases I have seen has been the securing of drainage of the under surface of the skull. Opening down to the dura accomplishes this and prevents extension through the dura. In the future, I should open a fairly large area of skull to the dura and pack away the dura from the diseased skull until the fibrous walling off process was completed. These cases have a bad habit of flaring up just when you think you have cleared them up. The infection travels extensively through the diploic veins of the skull.

DR GEORGE M COATES. The organism in most of these cases is the staphylococcus. What organism was found in this case?

DR FRANCIS C GRANT. Many of Adson's cases are due to roentgen burns with superimposed infection. The infection is secondary and his cases do not strictly parallel those about which we are speaking.

DR STEPHEN D WEEDE. Herbert Tilley mentions the production of a trough in the bone which efficiently prevents the spread of infection.

Book Reviews

THE MECHANISM OF THE LARYNX By V. E. NIGUS, M.S., London Price, \$16.50 St. Louis C. V. Mosby Company, 1929

This is a monograph of 258 pages profusely illustrated from drawings for the most part original. Some idea of the comprehensive manner in which the study is carried out can be gained from the headings for the several chapters: Evolution of the Larynx, Modifications for Olfaction, Modifications for Respiration, Modifications for Specialized Mechanisms of Respiration, Function of Movements at the Glottis During Respiration, Modifications for Deglutition, Modifications for Regulation of Intrathoracic Pressure, Mechanism to Prevent Exit of Air from the Lungs, Purposive Use of Sound in Relation to the Sense of Hearing, Employment of Sound as a Means of Communication, Mechanism of Phonation, Physiologic Anatomy of the Human Larynx, Observations on the Evolution of Man from the Evidence of the Larynx.

The volume shows an exhaustive study of the larynx from various angles. The author provides a comprehensive index which enables the student to turn to a discussion of any phase of the subject in which he may be interested.

It is rare indeed that a monograph of this sort is presented to the public. The volume will stand for a long time to come as a last word on the evolution of the structure and the function of the larynx.

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NEURO-OTOLOGICAL OBSERVATIONS IN CONCUSSION OF THE BRAIN *

FRED H LINTHICUM, M D

AND

CARL W RAND, M D

LOS ANGELES

Vertigo, in some form, is perhaps the most persistent symptom following concussion of the brain. Approximately 90 per cent of the patients describe some degree of equilibratory disturbance ranging from a mere feeling of uncertainty to actual systematized vertigo.

In work on industrial accidents it is frequently difficult to determine how much foundation in fact there is in the constant complaint of posttraumatic dizziness, in other words, it is difficult to evaluate how much is organic, and how much is functional. If a person who has sustained an injury to the head states that he is dizzy, what means has one to corroborate his statement? This question is especially important when the factor of compensation for disability must be considered. A means at hand to throw light on the problem seems to offer itself in the functional tests of the kinetic-static labyrinth, over the responses of which the patient has little, or no, control. This circumstance does not obtain in the functional tests of hearing in which the personal element plays no small part in interpretation. Abnormal neurologic observations are frequently absent, as is brought out in the appended reports of cases in which the patients suffered from concussion. If this is true, and the patient still complains of being dizzy, one cannot dismiss his claim as valueless, if it can be demonstrated objectively that the equilibratory apparatus is deranged. If, on the other hand, a person states that he is incapacitated for work on account of dizziness, and a normally functioning vestibulo-auditory mechanism can be demonstrated, it may be assumed that either there has been an exaggeration of the injured person's subjective symptoms, or there is actually present a vertigo of

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psychogenic origin, whether or not the latter form does occur does not concern us at this time

The series of concussion cases presently to be reported, when viewed purely from neuro-otological evidence, would seem to indicate that there is an actual basis for the symptom of dizziness, since, in no instance, have entirely normal vestibular responses been demonstrated and in the majority of cases the deviation from normal was sufficiently large to class them as being distinctly pathologic. One might therefore infer that an injustice has frequently been done by denying compensation for alleged incapacity to work on account of postconcussional dizziness. At least it would seem that the patient is entitled to an investigation of his equilibratory apparatus by functional tests of his inner ear.

The following observations have been made in an attempt to evaluate by objective evidence the relation of traumatic vestibular damage to subjective postconcussional vestibular symptoms. The material from which the data were compiled consists of thirty-six instances of concussion of the brain which were referred by the California State Compensation Insurance Fund, the Los Angeles General Hospital and through other channels. In a number of instances it has been possible to follow the patient by neurologic and neuro-otological observation over periods ranging from nine days to two years.

A general history, as well as a neurologic and a general physical examination, was made in each instance. Following this a history pertinent to symptoms of the inner ear was obtained and this was completed by the carrying out of functional hearing tests, and the observation of spontaneous and elicited vestibular phenomena.

HISTORICAL DATA

As far back as 1890, Risk¹ mentioned traumatic injury to the labyrinth. As was usual during that period, the labyrinth was considered only from the standpoint of its acoustic function. He made no comment on vestibular symptoms as considered today.

In 1901, Halsz² described definite vestibular symptoms such as the presence of postural vertigo as a result of a gunshot wound. He described two classes of trauma of the inner ear: direct traumatic injury and indirect injury brought about by sudden fluctuations of pressure in the external auditory canal, such as loud sounds or concussion. Five

1 Risk, E. J. E. A Case of Traumatic Injury to the Labyrinth of the Right Ear, Successfully Treated with Injections of Pilocarpine, *Brit. M. J.* **1** 234, 1890.

2 Halsz, Heinrich. Zur Lehre der Labyrinthverletzung, *Wien. med. Wchnschr.* **51** 1538, 1901.

years later, Rhese,³ in reporting a series of forty-five cases of people suffering from concussion of the brain, noted as frequent symptoms disturbances of equilibrium and diminished hearing of the receptor type. His observations at this date had to do mostly with spontaneous postconcussional symptoms of the inner ear as distinguished from induced phenomena. In 1905 Passow⁴ made the observation that in severe injuries to the skull the inner ear is practically always involved. In 1909, Stenger⁵ described in detail microscopic and gross pathologic observations in the inner ear following death from fracture of the skull and concussion. He concluded that the direct effects of labyrinthine concussion are (1) alteration of the nerve, ganglion cells and nerve endings (2) extravasations of blood, and (3) changes in pressure in the perilymph and endolymph content of the labyrinth.

In 1914 Emil Amberg,⁶ in an article entitled "Injuries to the Head and Ear Disturbances" discussed the effects of indirect damage to the inner ear following injuries to the head. He viewed the problem, however, only from the standpoint of acoustic involvement. He mentioned "commotion of the acoustic nerve" caused by small extravasations of blood into the labyrinth. He noted that comparatively slight blows can cause severe derangement of the inner ear, and quoted Politzer to the effect that after such injuries connective tissue has been found in the labyrinth as early as the end of the fifth week. However, his conclusions were based on observations confined entirely to the acoustic portion of the inner ear.

In his first article which appeared in 1916 during the analysis of six cases of injury to the head Mygind⁷ made the observation that it was difficult to distinguish between organic and functional vestibular disease. Later, in 1917, in a review of a previous work, "Vestibular Examinations of Patients Suffering from Injuries to the Head," he analyzed the vestibular observations in 142 patients who had received injuries to the head, half of this number had suffered from concussion. A spontaneous nystagmus was observed in 26 instances. 44 of the patients had spontaneous past pointing. In our series the percentage of the

3 Rhese Ueber die Beteiligung des inneren Ohres nach Kopferschütterungen mit vorzugweiser Berücksichtigung derjenigen Fälle, bei denen die Hörfähigkeit für die Sprache garnicht oder nur in einem praktisch nicht in Betracht kommenden Grade gelitten hat, *Ztschr f Ohrenh* 52:320, 1906

4 Passow, K. A. Die Verletzungen des Gehörorganes, Munich, J. F. Bergmann, 1905

5 Stenger Beitrag zur Kenntnis der nach Kopferletzungen affretenden Veränderungen im inneren Ohr, *Arch f Ohrenh* 79:43, 1909

6 Amberg, Emil Injuries to the Head and Ear Disturbances *J Michigan M Soc* 13:84, 1914

7 Mygind, S. H. Traumatic Vestibular Diseases, *Acta oto-laryng* 1:513, 1918-1919

latter observation was somewhat higher. Mygind went on to observe that the postrotatory nystagmus as observed in 78 persons "seldom showed pathologic reactions." In the series herein reported, only 13 of the 35 persons on whom the rotation test was carried out demonstrated what would approximate a normal postrotatory nystagmus. At his hands, caloric examination in regard to both nystagmus and past pointing again failed to elicit as high a percentage of abnormal observations as we have encountered. He stated, "the pointing test after postrotatory and caloric experiment often showed only modified or an unaltered spontaneous (sic) deviation." In contrast, practically 100 per cent distortion of the postcaloric or postrotatory past pointing was found in our series. Induced vertigo or motion sensing, as a rule, was absent or shortened. Constitutional symptoms or responses from the vegetative nervous system, in the form of nausea, sweat or pallor, were also usually absent. Spontaneous vertigo accompanied by nystagmus could often be elicited by movements of the head. He also distinguished between the various types of equilibratory disturbances. He agreed with us in the observation that the posttraumatic vestibular symptoms are seldom accompanied by demonstrable involvement of the other cranial nerves. A further observation in accord is the frequency of delayed vestibular symptoms following injury, and likewise the decreasing irritability of the vestibular organ to artificial stimulation in subsequent examinations. The prognosis for recovery from vertigo is said to be good. This statement is contrary to our experience. He noted that this symptom is especially manifest when any work is undertaken which entails stooping or working at high altitudes. The statement is made that only one case of the series showed vestibular symptoms suggestive of cerebellar injury. We are inclined to believe, on the contrary, that a large percentage of postconcussional labyrinthine symptoms are due to injury to this part of the brain. This will be discussed presently.

Gottlieb⁸ mentioned the lack of relation between the return of auditory function and the disappearance of vertigo. He pointed out abnormalities in past pointing in two cases in which at the same time were found horizontal canals responsive to the rotation test in the presence of markedly hypo-active responses from the vertical canals to douching. We have frequently noted this phenomenon.

Fletcher,⁹ in a review of the subject in 1922, stated that the only way to determine the difference between psychogenic and organogenetic postconcussional vertigo is by means of neuro-otological tests. Hof-

8 Gottlieb, Mark J. A Report of Two Cases of Head Injury, with Abnormal Oto-Neurological Findings, *Laryngoscope* **32** 783, 1922.

9 Fletcher, Harold A. Determination of Disability as to Loss of Hearing and the Importance of Vertigo in Industrial Accident Cases, *J A M A* **79** 529 (Aug 12) 1922.

mann¹⁰ concluded that the phenomena noticed after concussion are due to injury to the end-organ itself rather than to central involvement. As will be seen later, we do not subscribe to this view. Brunner's¹¹ comprehensive work will be reviewed elsewhere in this paper.

Schuster¹² estimated that "forty per cent of all head injuries produce ear symptoms. These are impaired hearing, dizziness, tinnitus and nystagmus." His statement that the caloric tests in these cases "reveal normal irritability" is in direct contrast with our observation that in nearly all instances, at least in those in which concussion has been demonstrated, it has been possible to elicit abnormal post-caloric vestibular observations.

Osnato and Giliberti,¹³ in a recent analysis of 100 cases of concussion, grouped dizziness and giddiness under one heading and found it present in fifty-seven of their cases. We place this observation at about 90 per cent.

Grove,¹⁴ in a recent comprehensive survey of the subject, remarked that postconcussional vertigo, if of vestibular origin, is characterized by systematized dizziness accompanied by nystagmus brought on by movements of the head. He classed other types of equilibratory disturbance as of neurotic origin. His observations of abnormal responses after stimulation are considerably lower than our experience would warrant. He expressed the belief that most spontaneous phenomena of postconcussional vertigo are due to a decompensation or imbalance between the two labyrinths.

VERTIGO

Vertigo has been described as a disturbance in the relationship of one's self to external objects in space. We shall not attempt to adhere strictly to the letter of this definition. It is doubtful if most of the disturbances of the equilibratory apparatus, as described by people who have suffered from cerebral concussion, could be covered by this description. Most of them will not admit of experiencing any systematized motion sensing. They describe their sensations variously, as a "giddiness," "unsteady on feet," "tendency to fall in various directions without giddiness," "waverling of objects," "feeling as though head

10 Hofmann, L. Lesion labyrinthique avec dissociation nystagmique consecutive à un traumatisme crânien, *Ann d mal de l'oreille du larynx* **44**:1254, 1925.

11 Brunner, H. Pathologie und Klinik der Erkrankungen des Inner-Ohres nach Stumpfschädeltraumen, *Monatschr f Ohrenh* **59**:697, 763 and 922, 1925.

12 Schuster, F. B. Head Injuries with Ear Symptoms, *Southwestern Med* **11** 116, 1927.

13 Osnato, M., and Giliberti, V. Postconcussion Neurosis—Traumatic Encephalitis, *Arch Neurol & Psychiat* **18**:181 (Aug) 1927.

14 Grove, W. E. Otologic Observations in Trauma of the Head, *Arch Otolaryng* **8** 249 (Sept) 1928.

goes up and down," "dazed feeling," "sensation as if going up in an elevator," "objects receding," "mental confusion, especially in crowds or under any unusual stress, or on looking upward," or that their heads "sway like a swing" The majority of these sensations are not to be classed as true vertigos Only four of the thirty-six patients described what could be considered as true motion sensing, i e., of experiencing the sensation of objects revolving around them in a definite manner Of interest is the fact that the vertigo induced at the time of the vestibular tests rarely corresponded in type to the vertigo of which the patient complained as a symptom

Vertigo, or motion sensing, may be divided into two types

1 True or systematized vertigo, in which external objects appear to revolve around the subject in a definite direction This type of motion sensing is usually considered to originate in the end-organ and is often associated with spontaneous labyrinthine phenomena, such as nystagmus, past pointing and characteristic disturbances in station

2 False or nonsystematized vertigo, which may be simply a feeling of uncertainty or confusion The latter form of equilibratory disturbance may be caused by ocular disturbances or intracranial lesions involving the vestibular tracts, or it may be due to so-called neurasthenic vertigo In other words, it does not originate in the end-organ, but may be the result of a derangement of the ocular, tactile or joint muscle sense or a combination of any of these

According to Hubby,¹⁵ the latter type of equilibratory disturbance is the result of interference with the intracranial vestibular pathways Conversely, vertigo originating in the end-organ is usually associated with spontaneous labyrinthine phenomena, especially during the early state of the disturbance

That these posttraumatic equilibratory disturbances are of prolonged duration is shown by the following facts Twenty-seven patients showed little or no improvement in the subjective vertigo over periods of observation extending from nine days to twenty-four months The vertigo was stated to become progressively worse in one instance Seven patients claimed improvement As before intimated, we have several times observed a progressive decrease in induced vestibular responses coincident with an improvement in the vertigo

PATHOLOGIC CONSIDERATIONS

The pathologic processes that bring about posttraumatic vertigo naturally fall into two large divisions (1) injuries to the inner ear, and (2) injuries to the eighth nerve, its intracranial pathways and nuclei Brunner stated that one can have concussion of the brain without having concussion of the inner ear, but one cannot have concussion

¹⁵ Hubby, Lester Mead The Modus Operandi of Vertigo, Arch Otolaryng 6 405 (Nov) 1927

of the inner ear without having concussion of the brain. Our experience indicates that in nearly all instances the vestibular symptoms following concussion are due to a combination of end-organ and central injury. Brunner produced concussion experimentally by striking animals on the head with varying degrees of force. He found postmortem evidence in the form of blood and fibrin in the cochlea and ductus cochlearis, serous exudate, edema of the organ of Corti and hemorrhage into the nerve. He also reported the presence of hemorrhage into the internal auditory meatus and exudate in the cochlea and vestibule in persons who had met death as a result of injury to the head. He summarized his data both from experimental and from clinical observations as follows:

In experimental concussion of the brain, there are found, as a rule, degenerative changes in the nuclei of the cochlear and vestibular nerves—especially the latter. These degenerative changes last as long as the animal survives the trauma. The changes in the brain are partially due to the direct effect of the trauma on the brain tissue and partially to the circulatory disturbances brought about by the trauma within the skull. The prognosis in cases of concussion is made with the understanding that periodic attacks of vertigo persist for many years. It is possible to demonstrate concussion of the brain with symptoms in the ears by vestibular observations and symptoms. The observations in experimental concussion are manifest mostly in the blood vessels, in the perilymph and endolymph, in the aqueductus cochlearis, and in the formation of connective tissue and the occurrence of hemorrhage. If there is an impairment in auditory function following concussion, the prognosis is poor for the return of hearing.

Concussion of the inner ear in conjunction with concussion of the brain, is probably brought about by the same mechanical means. Brünner assumed the establishment of a prestatic circulation with the formation of exudate in the structures of the inner ear. The latter has been termed *otitis interna serosa*, or *otitis interna vasomotoris*.

Injuries to the eighth nerve itself in the form of hemorrhage or lacerations are probably more common than injuries to other cranial nerves, with the probable exception of the seventh. An explanation would be offered by the fact that these two cranial nerves, shortly after leaving the brain stem, enter the internal auditory meatus. This anatomic consideration would lend plausibility to the theory that the eighth nerve may be pinched or injured at its point of entrance into the fallopian canal in cases of concussion of the brain. The assumption would be that the brain stem has been displaced by the impact of the injury. In addition to this, the fact that the neurons of the eighth nerve are peculiarly vulnerable to toxins such as syphilis (Linthicum¹⁶) would also suggest that they might be particularly susceptible to trauma.

¹⁶ Linthicum, F. H. *Neuro-Otologic Studies in Central Nervous System Syphilis*, Tr. Pacific Coast Oto-Ophthalmological Society, 1923.

In the present series the preponderance of evidence, as judged by neuro-otological studies, points either toward injury to the inner ear in conjunction with its intracranial pathways or to damage to these pathways alone. We have not found evidence pointing to isolated injury to the inner ear following concussion. As evidence of central involvement are the following observations: the frequent occurrence of a much diminished, or even absent, past pointing after stimulation, in the presence of hyperactive nystagmus, the induction of perverted nystagmus, the infrequent presence of spontaneous past pointing and nystagmus, in relatively few instances, the production of a postural nystagmus, postural vertigo, that is, attacks of dizziness with the head in certain positions, frequently noted without a simultaneously occurring nystagmus, the rare correspondence of spontaneous disturbances in equilibrium described by the patient to the vertigo produced by artificial stimulation of the labyrinth, and the observance that the severity of the symptoms complained of are usually out of all proportion to the degree of the spontaneous phenomena observed.

Another more or less consistent observation suggesting central involvement is the frequency of marked vestibular derangement in the presence of normal or but slightly impaired hearing. It is improbable that there would occur concussion of the inner ear alone sufficiently severe to alter the vestibular responses without at the same time interfering to some extent with auditory function.

Again, one of the most consistent observations throughout the series was the failure of the person being examined to past point properly after stimulation by either turning or douching. Of all of the vestibular responses to which we may attach any significance as diagnostic measures, past pointing is least understood. In a general way, absent past pointing, or crossed pointing after stimulation, is supposed to be suggestive of cerebellar involvement. It was interesting to note that in one instance a person examined shortly after an accident showed an entire absence of past pointing in the presence of hyperactive nystagmus. Reexamination a few months later showed the past pointing still to be absent and the nystagmus to have disappeared completely. There is some evidence to show that impulses for vertigo aroused by artificial stimulation are relayed through the cerebellum in their transmission from the ear. The universal occurrence and persistence of vertigo, together with this more or less constant perversion or absence of past pointing in cases of concussion, suggests that in addition to damage to other central structures, we are dealing as well with cerebellar injury or irritation. Greenacre¹⁷ reported fifteen cases of traumatic pontile

17 Greenacre, Phyllis. Bull. Johns Hopkins Hosp. 28: 86, 1917.

hemorrhage in which points of punctate bleeding were found to be grouped around the periphery of the pons. Such injuries to the pons and cerebellum suggest an explanation for the high percentage of abnormal past pointing.

AUDITORY PHENOMENA

Functional hearing tests were carried out in thirty-two instances. The auditory phase will be considered only in its relation to the vestibular picture. There were only six persons who failed to show some impairment of the receptor or inner ear type, manifest by the usual shortening of bone conduction and loss of acuity for high tones. Of this group, the impairment was unilateral in eleven instances and bilateral in the remaining fifteen. Of the six cases in which there was no manifest auditory impairment, only one failed to exhibit well defined vestibular abnormalities.

The auditory impairment coincided with the vestibular abnormalities in twenty examinations and disagreed in twelve. By this is meant that the auditory damage was not always homolateral with the more marked vestibular involvement. In the cases that were rechecked, the hearing was found to have improved in three, retrogressed in two and remained unchanged in two. In no instance, however, was there any corresponding change in the vestibular responses, except for the worse, and on only one occasion was the auditory acuity markedly reduced without a corresponding distortion of the vestibular reactions.

POSTCONCUSSIONAL CEREBELLOPONTILE ANGLE SYNDROME

Probably the most frequent intracranial condition to be diagnosed by means of vestibulo-auditory tests is the so-called cerebellopontile angle syndrome. The lesion either may be an acoustic tumor arising from the eighth nerve itself, or may be brought about by invasion of the angle by new growths having their origin in the cerebellum or pons. Accumulations of fluids or cysts may give a similar picture. The syndrome, in brief, is as follows: on the affected side there are usually tinnitus and impairment of hearing of the receptor or inner ear type, all of the canals fail to respond to douching. On the opposite side, there is no tinnitus or impairment of hearing, the horizontal canal alone responds to douching. We have encountered six instances of concussion which simulated in whole, or in part, the typical cerebellopontile angle syndrome. From a neuro-otological standpoint the chief point of difference between the two conditions was the fact that in the post-traumatic cases there was no constant impairment of auditory function. In pontile angle lesions especially in tumors of the acoustic nerve, a history of early unilateral auditory impairment can usually be elicited.

which, on functional tests, proves to be of the receptor type. The relation between the auditory and vestibular observations in the six cases of simulated pontile angle tumor is as follows:

Auditory Symptoms

Bilateral impairment, receptor type, equal on the two sides, tinnitus present, not lateralized

Bilateral impairment, receptor type, more marked on the right side, tinnitus absent

Bilateral impairment, receptor type, equal on the two sides, tinnitus present, not lateralized

Bilateral impairment, conductive type, more marked on the right side, tinnitus lateralized to the right side

Bilateral impairment, receptor type, complete on right side, tinnitus present, not lateralized

Right-sided impairment, receptor type, tinnitus (?)

Vestibular Symptoms

All the canals on the left side and the right vertical canals fail to respond. The right horizontal canal is active.

All canals on the left side and the right vertical canals fail to respond. The right horizontal canal is active.

All the canals on the left side and the right vertical canals fail to respond. The right horizontal canal is active.

All the canals on the right side and the vertical canals on the left side fail to respond. The left horizontal canal is active.

All canals on the right side and the vertical canals on the left side fail to respond. The left horizontal canal is active.

All canals on the right side and the vertical canals on the left side fail to respond. The left horizontal canal is active.

It will be seen that in the postconcussional angle syndrome, cochlear impairment is by no means so constant as in the other types enumerated. Consequently, the determination of the degree of auditory damage, together with a careful history, makes it possible to differentiate between the two conditions. What pathologic changes bring about this picture in posttraumatic cases? One could assume a collection of fluid, organized clot or some similar lesion in the region of the pontile angle on the affected side. Why such a lesion, the nature of which is not clear, should affect the vertical canals on the opposite side, we can no more surmise than we can in cases of tumor of the acoustic nerve. These observations following injuries to the head emphasize the importance of an accurate history and complete auditory examination before making a diagnosis of a cerebellopontile angle tumor purely from a neuro-otological study.

A similar case was reported by Zachs¹⁸

HISTORIES

Independent neurologic and neuro-otological histories and examinations were obtained in practically all instances. In these inquiries,

¹⁸ Zachs, Myron A. Interesting Cochlear and Vestibular Findings Following Accident, *Laryngoscope* 38:288, 1928.

special stress was laid on the following points Whether or not there had been any previous auditory or vestibular disease whether or not the patient was unconscious following the accident, on what part of the head the injury was sustained, whether there was bleeding from one or from both external auditory canals, the interim after the injury when vestibulo-auditory symptoms appeared, whether the symptoms were brought on by postural changes whether or not the vertigo was systematized whether the symptoms were progressive or retrogressive, the presence or absence of disturbance in gait or station, visual disturbances and whether or not there was an accompanying tinnitus and nausea at the time of the attacks Too much stress cannot be laid on the accuracy of the history as it plays no small part in the final determination of the extent of injury and the consequent prognosis

SPONTANEOUS PHENOMENA

As spontaneous phenomena we list nystagmus, past pointing and disturbances in station which occur independently of stimulation in the form of turning or douching The observance of spontaneous phenomena after concussion is remarkably small We encountered spontaneous nystagmus in ten patients, horizontal nystagmus in seven and rotatory nystagmus in three It must be borne in mind that spontaneous nystagmus may be present at one examination and absent at the next Its presence or absence depends largely on how soon after injury the inspection is made Children and young adults seem to show spontaneous nystagmus following injury more frequently than older persons Vertical nystagmus has not been observed

The majority of patients who exhibited a spontaneous past pointing were found to have hyperactive responses on rotation This did not hold for the caloric test Spontaneous past pointing occurred much more frequently than spontaneous nystagmus, being observed seventeen times It was usually in the direction of the more affected ear Only six of the persons exhibiting spontaneous nystagmus were found to have spontaneous past pointing Spontaneous falling was observed in fourteen instances Only twice was this disturbance in station of the so-called end-organ type observed By this is meant given for example, a lesion in the right inner ear the person tested is supposed to fall toward this ear regardless of the position in which the head is placed, i. e. with the face turned toward the right shoulder he will fall backward with the face turned toward the left shoulder he will fall forward In only two instances of this so-called spontaneous falling was there a coincident spontaneous nystagmus There were six instances in which the falling was always in the same direction regardless of the position of the head This is interpreted as implying a central rather than a

peripheral involvement. The foregoing differentiation of the two types of falling is merely suggestive, and too much significance should not be placed on its presence or absence.

In the cases rechecked, spontaneous nystagmus and past pointing were not found to be constant, that is, they would either disappear or reappear intermittently. Disturbances in station were found to be apparently unaffected by the passage of time, and they remained the same throughout all subsequent examinations. Postural nystagmus, by which is meant the induction of nystagmus by sudden changes in the position of the head, was elicited in only one instance. In the three patients in whom there was a falling reaction of the so-called end-organ type the spontaneous past pointing was to the same side. On the contrary, in the instances in which the falling was of the so-called central type, the past pointing was either absent or apparently bore no relation to the direction in which the falling took place.

INDUCED NYSTAGMUS

Postrotatory Nystagmus—In general, it may be said that the nystagmus after turning approached much nearer to normal, in direction, quality and amplitude, than any of the other responses. In these tests we employed the routine procedure of turning the patient ten times in twenty seconds with the head inclined 30 degrees forward. We took as normal an after-nystagmus of from twenty to twenty-four seconds duration. A longer or shorter duration was considered as hypo-active or hyperactive, respectively.

Of the thirty-five persons rotated, hyperactive nystagmus was encountered seven times, normal nystagmus was present in thirteen, and hypo-active responses were obtained in fifteen instances. On only one occasion did we encounter an entire absence of postrotatory nystagmus. Discrepancies in the duration of the nystagmus from the two sides in the same person varied from five to fourteen seconds and occurred twelve times. One would expect the most marked differences in responses from the two sides to appear when the examination was carried out shortly after the injury, before so-called vestibular compensation had commenced. This was found to be the case. In three of our cases in which a marked discrepancy in postrotatory nystagmus was observed at the time of the initial examination, this compensation was found to have taken place when the patients were subsequently tested. For example, patient C-3 (table 2, case 1) was rotated six months after injury. Turning to the right elicited a horizontal nystagmus of twenty-five seconds' duration, turning to the left, a nystagmus of sixteen and one-half seconds' duration. Three months later the nystagmus was of fifteen seconds' duration on each side.

Experimentally, it has been shown that if the labyrinth on one side is destroyed and the rotation test is carried out soon afterward, there will be an approximately normal response from the uninjured side and a shortened or absent response from the destroyed side. Conversely, if in from nine months to a year the subject is again tested, it will be found that his vestibular responses will be approximately equal from the two sides, with the difference that the duration of the nystagmus from each side will be approximately one-half the normal.

In marked contrast to the generally active functioning of the horizontal canals to the turning test was the frequent failure of the same canals to produce nystagmus after douching. The caloric test has the advantage of determining the function of each inner ear individually as distinguished from the rotatory procedure, in which both labyrinths are stimulated at the same time. After douching it was frequently noted that a normal nystagmus was obtained from one side in the presence of an absent, decreased or perverted nystagmus from the opposite side. By perversion in this instance is meant either a rotatory or a vertical nystagmus where a horizontal nystagmus should obtain, or conversely. In five of the seven cases which were followed by vestibular reexaminations, the postrotatory nystagmus was found to decrease in duration on subsequent examinations. In these there was apparently a loss of responsiveness to stimulation as time elapsed after injury. In the cases in which it was shown by the caloric test that one horizontal canal was functioning to the exclusion of that on the opposite side, especially when the examination was carried out soon after the injury, one would expect that postrotatory stimulation would bring out a similar difference between the two sides. This was not found to be the case. In two instances in which the vestibular tests were carried out four months after injury the postrotatory nystagmus was apparently equal and normal on the two sides, while douching revealed a definite perversion of response from one horizontal canal, with the opposite side showing a normal reaction. In most instances, however, the responses from the horizontal canals both for douching and for turning were consistent. The two instances cited, however, bring up the much debated question as to whether or not one stimulates the same part of the end-organ by turning as by douching, or, at least, whether one stimulates it in the same manner.

Caloric Nystagmus—The technic for the caloric test was carried out by mass irrigation. The patient was in the erect position and the head inclined 30 degrees forward, the ear was douched with water at 68 F until a nystagmus became manifest. The period elapsing between the beginning of the irrigation and the appearance of the nystagmus was noted. The irrigation was then continued for three minutes, if the condition of the patient permitted. The head was then tilted back, and

the nystagmus again noted. Past pointing was carried out with the head in both positions, and the presence or absence of vertigo and constitutional symptoms observed.

As a rule, it may be stated that the vertical canals were either non-responsive or hyporesponsive to the caloric test. In thirteen persons there was no postcaloric nystagmus from the vertical canals from either side. In ten it was present on one side and absent on the other. When this condition obtained, the nystagmus on the responsive side generally, if not always, was delayed in making its appearance. It was hyperactive in five instances on both sides and in one case on a single side. In only four tests could the responses from the vertical canals, as regards nystagmus, be considered within normal limits. In nine of the examinations the horizontal canal was found to give normal responses on the same side on which it was not possible to elicit responses from the vertical canals.

PAST POINTING

Abnormal past pointing was the most consistent of all observations, only twice in the series could the past pointing after turning be considered within normal limits. The most frequent aberration in this test was the repeated occurrence of crossed past pointing. By this is meant a deviation, after turning, of one or both arms in a direction opposite to the one to be expected. It was frequently absent in one or both arms, or absent in one arm and crossed in the other, or again entirely absent in both arms. Analysis of past pointing, as related to nystagmus after rotation or douching, is practically impossible.

When testing for past pointing it must be remembered that the subjective element plays a much larger rôle than it does in the nystagmic responses, or in the so-called constitutional symptoms. Nevertheless, even when this factor is discounted, one cannot but be impressed by the remarkable and consistent perversion of past pointing as a postconcussional phenomenon. Hardly less constant are the absent or subnormal constitutional symptoms. A normal person whose ears are doused with cold water will, within approximately a minute, become actively ill, or at least show signs of distress arising through stimulation of the vegetative nervous system. The failure of nausea, sweat and pallor to occur, even after prolonged stimulation and often in the presence of an active nystagmus, again suggests the possibility of intracranial derangement of the vestibular mechanism in concussion.

RECHECKED CASES

It was possible to follow with reexamination six cases of concussion over periods varying from three to twenty-four months. These cases deserve discussion in some detail. They are summarized in table 2.

The first patient (C-3) was seen six months after injury. The initial examination revealed a complete deafness of the inner ear on the left side with rather marked auditory impairment on the right side. He showed no spontaneous nystagmus, but exhibited a tendency to fall to the left. He past pointed spontaneously to the right with the right arm and to the left with the left arm. After turning, there was an active horizontal nystagmus from both sides, which was shorter after turning to the left. After douching, the right vertical canals responded normally, while the left ones produced a nystagmus only after two minutes. When the head was put back, the nystagmus from the left horizontal canal was found to be perverted. Past pointing was absent in the right arm after douching the left ear. He was tested again three months later. Auditory function on the left was still absent, there was some evidence of return of hearing on the right side. The spontaneous observations remained unchanged. Nystagmus after turning to the right had dropped to fifteen seconds, but was found to be the same after turning to the left. The nystagmus after douching of the left ear had disappeared from both the horizontal and the vertical canals. The other observations remained the same. He was checked a third time a year after his accident. The auditory observations were the same. There was no change in the spontaneous phenomena. The nystagmus and past pointing after turning and douching were the same as on the last examination. Five months later he was again tested. There was a slightly lessened irritability of the right labyrinth, subjectively, there was no improvement. His next examination was four months later. There was no change worthy of comment in the vestibular picture. He was still troubled with vertigo to the extent that he could not work. On the final examination, his condition had apparently become stationary.

This patient had six vestibulo-auditory examinations carried out over a period of nearly two years. The history was that of an injury over the left mastoid process, which rendered him unconscious. He complained of deafness immediately following the accident and dizziness, the latter was precipitated chiefly by sudden movements of the head to the left. He had a "roaring" tinnitus which was aggravated during his attacks of vertigo. Over the period of examinations, there was no improvement in his subjective symptoms as first described. There was no demonstrable change in his hearing. The results of vestibular tests remained practically unchanged throughout the period of observation except to show a slight decrease in the ability of the right labyrinth to respond to the tests and a negligible return of function in the left labyrinth. At the end of two years his vertigo was such as to incapacitate him for work.

The second patient (C-50) was examined three times over a period of five months. He was first seen about nine months after his accident. He was unconscious for ten minutes. At the end of two weeks he attempted to work, but was unable to continue on account of dizziness and nausea, which were aggravated by quick movements of the head to one side. At the end of another week he again attempted to work. He then noticed that his gait was uncertain and that he tended to deviate to the right. At the end of five months, during which time he remained idle, avoiding any exertion, his subjective symptoms had improved. Although there was an occasional slight uncertainty of gait, he no longer deviated toward the right. Quick movements still caused blurring of vision, which was less marked than at first. Objectively, there was a decrease in the vestibular responses to stimulation. The picture changed from a state of hyperactivity of the left labyrinth after douching to one of hypo-irritability. The spontaneous nystagmus seen on the first examination had disappeared. The auditory picture remained the same.

We here note an improvement in the subjective symptoms coincident with a decrease in vestibular function.

A third patient (C-59) was first examined one month after his accident and again five months later. His auditory impairment was of mixed conductive and receptor type. It had become more marked at the time of his second examination. The spontaneous past pointing and falling, which were present at the initial examination, were absent subsequently. The nystagmus after turning showed a decrease in response from the left horizontal canal at the second examination, while the caloric nystagmus dropped out entirely after having shown fairly good responses at the first test. In like manner the past pointing subsequently disappeared. The whole picture showed a decrease in labyrinthine responsiveness and an improvement in the subjective symptoms of vertigo and uncertainty in gait.

The fifth patient (C-67) was examined at periods of two months and five months subsequent to his injury. There were no spontaneous observations and slight auditory impairment. The nystagmus after douching of the right ear was normal at the first examination and had disappeared at the second examination. The left ear showed marked hypo-irritability on a second examination. Past pointing was absent throughout after the caloric tests.

The sixth patient (C-2) was first seen four months after his injury, again in a year and a third time nine months later. There was an apparent complete nerve deafness on the right side and moderate impairment on the left. On the final test, some auditory improvement was noted on both sides. At all times vestibular responses were absent on the right side. The vestibular picture remained the same while he was under observation. Subjectively, there was considerable improvement.

There were two facts to be noted in the six cases 1 There was a gradual loss of labyrinthine function as time elapsed after the accident 2 Coincident with this deterioration, a readjustment of the subjective symptoms of equilibratory disturbances took place up to a certain point

In analyzing this series, we hoped to establish some definite neuro-otological picture that would indicate whether postconcussional labyrinthine symptoms could be demonstrated by objective neuro-otological observations and whether these observations could be grouped in such a manner as to enable one to offer a prognosis for recovery We have found that definite vestibular abnormalities can be demonstrated in most postconcussional cases We have, however, been unable to group these abnormalities into a definite symptom complex, except that it would seem that the vertigo resulting from injury to the end-organ itself is much more liable to readjustment than are the various equilibratory disturbances due to damage to the intracranial pathways Consequently, if one can determine at the time of examination whether peripheral or central involvement is more in evidence, one is justified in attempting a prognosis In other words, if central damage predominates, the prognosis is poor, if the end-organ is at fault, the outlook is better

RÉSUMÉ OF CASE REPORTS

CASE 1 (County) —*Severe concussion*—A man, aged 59, a laborer, was admitted to the Los Angeles General Hospital on Oct 12, 1926, after he had been struck by an automobile while working on the road He remained unconscious for two days There was no bleeding from the ears Roentgenograms of the skull showed no fracture The Wassermann reaction of the blood was negative Neurologic examination gave essentially negative results, save for hyperactive knee reflexes No pathologic reflexes were elicited There were no pupillary or fundus changes

On Feb 3, 1927 the auditory test (audiometer) showed receptive type of lesion on the left side, the vestibular test spontaneous rotatory nystagmus to the left, delayed responses from the right vertical canals, oblique nystagmus from the right horizontal canal

CASE 2 (C-16) —*Linear fracture of the left parietal bone, concussion*—A man, aged 30, a rotary helper, was referred by Dr W T Cade, Jr, on Feb 4, 1926 He was injured on Nov 17, 1925, when he was struck on the head by a falling timber He was rendered unconscious for half an hour, and bled profusely from the left ear He returned to work two months later, but complained of generalized headache and dizziness on stooping Three months after the injury, neurologic examination gave essentially negative results, except for a dilated left pupil and unsteadiness of the eyes on looking to the right There had been almost total deafness in the right ear since childhood, the hearing were impaired on the left, and Weber's test was referred to the left Tests with the tuning fork showed the bone conduction better than the air conduction on the right side, and the air conduction better than the bone conduction on the left Roentgenograms of the skull showed a linear fracture in the left posterior parietal region extending to the external auditory canal The Wassermann reaction of the blood was negative

On Feb 17, 1926, the auditory test showed receptive type of deafness on the right, the vestibular test absent responses from all canals on the right, horizontal canal on the left functioning, a picture of angle tumor

CASE 3 (C-35) —*Mild concussion*—A man, aged 33, an interior decorator, was referred by Dr J Rollin French On April 15, 1926, while working on a scaffold, he bumped the top of his head against a beam of the ceiling He was not rendered unconscious, and did not fall He worked the rest of that day and for three days following, he then complained of headaches, poor memory, feeling of flightiness, insomnia and inability to work Roentgenograms of the skull were negative Neurologic examination, made by Dr Paul E Bowers, gave essentially negative results, except that the knee reflex and Achilles tendon reflex of the right side were quicker than those on the left

On July 28, the auditory test showed conductive type of lesion, bilateral, the vestibular test left horizontal canal, the only one to respond to douching, abnormalities in past pointing, neurologic picture of angle lesion without typical auditory observations

CASE 4 (C-48) —*Concussion, neurosis*—A man, aged 50, a laborer, was referred by Dr John D Gillis on June 7, 1926 He was injured on Feb 2, 1926, when he fell from a truck to the cement floor, striking the back of his head He was not rendered unconscious, and there was no bleeding from the ears He remained in bed for two days Subsequently, he began to have occipital headaches and dizziness, which persisted and became worse during the next eight months He complained of pain in the region of the right great occipital nerve, and a mild neurosis developed Roentgenograms failed to reveal a fracture of the skull The Wassermann reaction of the blood was negative Neurologic examination gave negative results, save for evidences of a neurosis Eight months after the injury he was still unable to work

On December 22, the auditory test showed bilateral lesion of the mixed receptive and conductive type, the vestibular test absent responses from the vertical canals on both sides, some function in the right horizontal canal, resembled vestibular observations in cases of angle tumors

CASE 5 (C-38) —*Severe concussion*—A man, aged 28, a street decorator, was referred by Dr J Rollin French On July 25, 1926, he fell about 25 feet from a ladder to the street He had no recollection of falling, and remained unconscious for a week Six weeks later he complained of dizziness, sinking spells, "sensation around my forehead which robs me of my energy," loss of memory, inability to study and headaches The neurologic examination made by Dr C G Johnson, was said to be negative, but the patient showed a peculiar mental make-up simulating dementia praecox He swayed in Romberg's position There was no bleeding from his ears Roentgenograms of the skull showed no fracture

On September 8, the auditory test showed very slight receptive type of lesion, bilateral, the vestibular test responses from the horizontal canals subnormal after turning, no response from the vertical or horizontal canals after douching

CASE 6 (C-0) —*Linear fracture of the right parietal region, concussion and contusion of the brain*—A man, aged 24, an oil worker, was referred by his employer on June 15, 1927 Two months previously he was thrown from his automobile, and was rendered unconscious, he remained so for three days There was marked bleeding from the right ear, and a right peripheral facial paralysis immediately followed Three months later he complained of headache, dizziness on exertion, ringing in the right ear and weakness of the right side of the face Neurologic examination gave negative results, except for dilatation of the right

pupil and a complete right peripheral facial paralysis. The sense of taste was lost over the right anterior two thirds of the tongue. He swayed to the right in Romberg's position. Roentgenograms of the skull showed a linear fracture in the right parietal region running toward the external auditory meatus.

On July 14, the auditory test showed no function in the right ear, receptive type of lesion in the left ear, the vestibular test marked impairment, no responses from the right side and only the horizontal canal functioning on the left side, typical picture of an angle tumor.

CASE 7 (C-60) —*Concussion, neurosis*—A man, aged 54, a carpenter, was referred by Dr W T Cade, Jr, on Oct 14, 1926. On Sept 7, 1926, he was struck on the right side of the head by a piece of timber which fell 10 feet. He remembered being hit, but soon became unconscious, remaining so for four hours. A hematoma developed, and he was told that he had a depressed fracture of the skull and that operation would be necessary. Five weeks later, he complained of headaches, dizziness and weakness. He was nervous and shaky. Neurologic examination revealed some overfilling of the retinal veins, an increase of the right knee reflex and active vasomotor disturbance. Marked neurosis was present. Roentgenograms of the skull were negative for fracture. The Wassermann reaction of the blood was negative. His neurotic symptoms remained unchanged for about a year.

On July 7, 1927, the auditory test showed receptive type of lesion, bilateral, and more marked on the left side, the vestibular test absent past pointing in the right arm after douching of the left ear, subnormal constitutional responses.

CASE 8 (C-66) —*Concussion*—A man, aged 35, a truck driver, was referred by Dr John N Osburn and Dr G F Boehme, Jr. He was injured on Dec 4, 1926, in a collision, when he was thrown from his truck. He was unconscious for several hours. Two weeks later his principal complaint was bilateral deafness. The results of the neurologic examination, by Dr G F Boehme, Jr, were reported as negative except for impaired hearing. Roentgenograms of the skull showed no fracture. The question of hysterical deafness or malingering arose.

On Aug 11, 1927, the auditory test showed conductive type of lesion on both sides, more marked on the left, the vestibular test total loss of responses after turning and douching.

CASE 9 (C-65) —*Mild concussion*—A man, aged 20, a carpenter, was referred by Dr J Rollin French. He was injured on May 23, 1927, when he was struck by a falling plank and knocked backward, striking his head against a brace. He was not rendered unconscious. Ten days later, he stated that he could not hear with his right ear. Neurologic examination, made by Dr C G Johnson on June 27, gave essentially negative results, except for impaired hearing on the right. Roentgenograms of the skull showed no fracture.

On July 8, the auditory test showed bilateral, mixed conductive and receptive type of lesion, more marked on the right side, the vestibular test the vertical canals did not respond on either side, abnormalities in past pointing.

CASE 10 (C-64½) —*Concussion*—A man, aged 54, a carpenter, was referred by Dr H E Southworth on April 23, 1926. He was injured on Dec 19, 1925, when he was struck on the head by a falling piece of steel and knocked 20 feet from a ladder. He remained unconscious for three hours. Four months later he complained of headache, dizziness and light-headedness. Following a dizzy spell, a severe frontal headache developed. The neurologic examination gave negative results. Roentgenograms of the skull revealed no fracture. His dizziness appeared to be out of proportion with the severity of his injury. He was observed for

more than two years, during which time he did not work, and he stated that the dizziness did not improve

On Aug 29, 1927, the auditory test showed receptive type of lesion on both sides, more marked on the left, the vestibular test vertical canals nonresponsive to douching, abnormalities in past pointing after douching of the right ear

CASE 11 (C-63) —*Depressed fracture of the skull, concussion and contusion of the brain*—A man, aged 28, an attendant at an oil station, was referred by Dr W T Cade, Jr, on July 13, 1925. He had sustained a compound, comminuted, depressed fracture of the skull in the left occipital region on May 3, 1925, when he was struck by an automobile and rendered unconscious. The depressed fragments of bone were removed as an emergency measure. There was bleeding from the left ear. He complained of headache, dizziness and impairment of hearing in the left ear. Two months after the injury neurologic examination showed an increase of all deep reflexes on the right side, as compared with those on the left, but otherwise gave essentially negative results, except for rather marked neurotic symptoms. He was observed for a period of three years, during most of which he was able to work, but continued to complain of headache, nervousness and dizziness.

On July 21, 1927, the auditory test showed acuity practically within normal limits, the vestibular test hyperactive vestibular responses from all canals, abnormalities in past pointing.

CASE 12 (C-47) —*Concussion*—A man, aged 51, a miner, was referred by Dr J Rollin French. On Aug 30, 1926, he was struck in the midfrontal region by a falling rock. He was dazed, but not entirely unconscious. There was no bleeding from the ears. He continued to work for about two weeks, when purulent otitis media developed on the right side, which continued for approximately four months. One month after the injury he complained of headaches, dizziness and insomnia. Neurologic examinations made by Dr C G Johnson and Dr Paul E Bowers were reported as negative. Roentgenograms of the skull failed to reveal a fracture.

On November 24, the auditory test showed conductive type of lesion on the right side, the vestibular test delayed responses from the right vertical canals, oblique nystagmus from the right horizontal canal, no response from the left vertical canals, absent past pointing from the right arm, crossed past pointing with the left arm after douching of the left ear.

CASE 13 (C-44) —*Mild concussion*—A man, aged 47, a laborer, was referred by Dr W T Cade, Jr, on Oct 27, 1926. He was injured on Oct 18, 1926, when he slipped on a cement floor, striking the back of his head. He remained unconscious for a few minutes. His principal complaints at the time of examination were occipital headache and marked dizziness. Neurologic examination showed the pupils to be irregular, the left being slightly larger than the right, they reacted well. Hearing was impaired on the right. There was a suggestive Babinski sign on the left, otherwise, the reflexes were normal. Roentgenograms of the skull were negative for fracture. The Wassermann reaction of the blood was negative.

On October 22, the auditory test showed slight impairment on the left, conductive type of lesion, the vestibular test practically normal, except for absent past pointing in the right arm. This was the nearest approach to a normal reaction encountered in instances of concussion.

CASE 14 (C-43) —*Mild concussion*—A man, a laborer, was referred by Dr W T Cade, Jr, on Oct 20, 1926. He was injured on Aug 13, 1926, in a cave-in,

when a large lump of clay struck him on the left side of the face and neck. He was stunned for a short time. For several days he complained of dizziness, which became worse when he arose from a recumbent position. Two months after the injury, the dizziness was not prominent. Several days after the injury, he complained of deafness and a buzzing sound in the left ear, he disclaimed any previous ear trouble. Neurologic examination was not available.

On October 20, the auditory test showed mixed conductive and receptive type of lesion on the left side, the vestibular test absent responses, absent nystagmus from the right vertical canals, tendency to conjugate deviation from both horizontal canals, subnormal constitutional symptoms and abnormalities in past pointing after douching of the right ear.

CASE 15 (C-42) —*Concussion* —A man, aged 25, a pipe fitter, was referred by Dr C E Gage. On Jan 9, 1926, the patient was struck behind the left ear with a sledge hammer. He was rendered unconscious for about an hour. Following this he complained of headache, dizziness and deafness in the left ear. Neurologic examination showed an increase in the knee reflexes and a positive Babinski sign on the left, but gave otherwise negative results. There was impairment of hearing on the left side. Roentgenograms revealed no fracture of the skull.

On October 15, the auditory test showed complete deafness on the left side, the vestibular test abnormal and perverted past pointing.

CASE 16 (C-30) —*Concussion* —A man, aged 31, a laborer, was referred by Dr W T Cade, Jr, on June 10, 1926. On May 7, 1926, he was struck on the back of the head by a falling bucket, and was rendered unconscious for four hours. There was no bleeding from the ears. He had violent headaches for the first few days, and six weeks later stated that "it felt as if the top of my head were coming off." He also complained of dizziness, which was severe after exertion. The head was tender over the great occipital protuberance. The neurologic examination gave negative results, save for sluggish pupils, a positive Romberg sign and unsteadiness and reeling in his gait. Roentgenograms of the skull failed to reveal a fracture.

On July 25, the auditory test showed no impairment, the vestibular test decreased responses from the right vertical canals and no response from the left vertical canals, abnormalities in past pointing.

CASE 17 (C-21) —*Depressed fracture of the skull and left parietal bone, concussion and contusion of the brain* —A man, aged 40, a clerk, was referred by Dr H E Southworth on Feb 20, 1925. He was injured on July 8, 1924, when he was struck on the left side of the head by a steel bar, being immediately rendered unconscious and remaining so for several hours. He sustained a compound, comminuted, depressed fracture of the skull in the left parietal region, and was operated on the same day. He showed complete aphasia and marked right hemiplegia. Both the hemiplegia and the aphasia gradually improved. Examination six months later showed some difficulty in speech and residual weakness of the right hand and the right side of the face. He complained of headache and dizziness. There were obtunding of smell on the left side and hypesthesia of the second division of the left trigeminal nerve. The fundi showed considerable new tissue in the optic cups and overfilling of the retinal veins. There was unsteadiness of the eyes on looking to the right and the left. The deep reflexes on the right side were increased as compared with those on the left. Roentgenograms of the skull showed a defect in the left parietal region.

On April 14, 1926, the auditory test showed hearing tests not done, the vestibular test right vertical canals failed to react to douching, no constitutional

symptoms, past pointing or vertigo in the presence of active nystagmus from the horizontal canals

CASE 18 (C-20) —*Psychoneurosis, concussion (?)*—A man, aged 42, a laborer, was referred by Dr C E Early on April 14, 1926. On May 25, 1925, he slipped on a concrete floor, striking the back of his head. He was not rendered unconscious and worked for the next four days. He then stopped because of headache, dizziness and impairment of hearing. Deafness was said to be greater on the right side than on the left. He claimed complete disability for a year following the accident. Four years prior to this he had injured his back, which had resulted in two and a half years of complete disability, the case going through Industrial Accident Commission channels. Neurologic examination showed a double internal strabismus with unsteadiness of the eyes on looking in various directions. The left pupil was larger than the right. He showed typical stocking anesthesia of both lower extremities of the hysterical type. Roentgenograms of the skull were negative for fracture. The Wassermann reaction of the spinal fluid and blood were negative.

On April 24, 1926, the auditory test showed slight bilateral receptive type of lesion, the vestibular test responses hyperactive after douching, abnormalities in past pointing.

CASE 19 (C-13) —*Concussion*—A man, aged 40, a miner, was referred by Dr Lawrence Chaffin. He was injured on Oct 16, 1925, when a small steam shovel fell, pinning him between it and the wall of the mine. He was unconscious for a few minutes, but later walked out of the mine. On reaching the surface, he complained of blindness and ringing in his ears. The blindness cleared up in four days. On Feb 2, 1926, he stated that he was totally deaf in the left ear. He had occasional attacks of dizziness. Neurologic examination, made by Dr Chaffin on this date, gave negative results, except for deafness of the left ear. Roentgenograms of the skull showed no fracture.

On February 3, the auditory test showed no function in the right ear, the vestibular test the right vertical canals failed to respond to douching, absent past pointing in the presence of an active nystagmus.

CASE 20 (C-11) —*Separation of the coronal suture, concussion, syphilis*—A man, aged 42, a laborer, was referred by Dr H E Southworth on June 26, 1925. On Oct 23, 1923, he was struck on the top of the head by a steam shovel, being rendered unconscious for about six hours. His principal complaints at the time of examination, three years later, were unsteadiness in gait, weakness of the right hand, dizziness, deafness of the right ear and tinnitus. Neurologic examination showed a spontaneous horizontal nystagmus on looking both to the right and to the left, moderate weakness of the right arm, marked ataxia of both upper and lower extremities, greater on the right, a strongly positive Romberg sign and a staggering gait. His deep reflexes were all sluggish, but equal. Roentgenograms of the skull showed slight separation of the coronal suture. The Wassermann reaction of the blood was strongly positive. Intensive antisyphilitic treatments had not helped him.

On Dec 23, 1925, the auditory test showed apparent total loss of the auditory function on the right side, the vestibular test spontaneous nystagmus to the left vertical canals nonresponsive on both sides to douching.

CASE 21 (C-9) —*Concussion (?) , neurosis*—A man, aged 50, a carpenter, was referred by Dr W T Cade, Jr, on June 30, 1925. On March 30, 1925, he fell backward from a low scaffold, striking his head on a cement floor. He was stunned, but went back to work a few minutes later and finished the day. The

following day, he complained of dizziness. Three months later, he still had headache and dizziness. Neurologic examination gave negative results. The patient had obviously developed a neurosis. Roentgenograms of the skull showed no injury. The Wassermann reaction of the blood was negative.

On November 18, the auditory test showed no abnormalities, the vestibular test spontaneous nystagmus to the right, responses hyperactive, abnormalities in past pointing.

CASE 22 (C-6) —*Concussion and contusion of the brain* —A man, aged 60, a laborer, was referred by Dr W T Cade, Jr, on Oct 3, 1925. On Aug 8, 1925, he fell through a causeway, being immediately rendered unconscious, he remained so for two weeks. Two months later, he complained of dizziness and bilateral deafness. He had no headache. Neurologic examination made on October 3, gave essentially negative results, save for impaired hearing on each side. Roentgenograms of the skull failed to reveal a fracture. The Wassermann reaction of the blood was negative. The patient was rather neurotic.

On October 5, the auditory test showed no abnormalities, the vestibular test no responses from the right side after douching, the left horizontal canal was functioning, a picture of angle tumor.

CASE 23 (C-51) —*Linear fracture of the right parietal bone, concussion and contusion of the brain* —A man, aged 40, a foreman on a ranch, was referred by Dr W T Cade, Jr, on June 3, 1926. He was injured on Feb 14, 1926, when his automobile went over an embankment. He remained unconscious for several hours, and was delirious for a month following. There was bleeding from the right ear. Four months later he complained of headache, and especially of dizziness on slight exertion. The dizziness continued for more than two years. Neurologic examination, made on June 3, showed the left pupil to be larger than the right, and impaired hearing on the right. Weber's test was referred to the right. His memory and calculating ability were poor. Roentgenograms of the skull showed a linear fracture of the right side running from the midvault to the external auditory meatus. The Wassermann reaction of the blood was negative.

On Jan 25, 1927, the auditory test showed bilateral and mixed conductive and receptive type of lesion, more marked on the right, the vestibular test the right horizontal canal showed a subnormal response after turning, the right horizontal canal was the only one on either side to function after douching, a picture of an angle tumor.

CASE 24 (C-26) —*Concussion, intracranial hemorrhage neurosis* —A man, aged 65, a fireman, was referred by an insurance carrier on March 16, 1926. On Jan 5, 1926, he fell backward 5 feet, striking his head on a piece of iron. He was momentarily dazed. The following day diplopia developed, which persisted for three weeks. Eight days after the accident left peripheral facial paralysis developed, which subsequently cleared up. He complained of headache and dizziness, which persisted for more than four years. He also complained of deafness and tinnitus on the right side. There was no bleeding from either ear at the time of injury. Neurologic examination, made on March 16, revealed slight weakness of the left sixth and seventh cranial nerves. Hearing was impaired on the right. Tests with the tuning fork showed bone conduction to be better than air conduction on the right side, and air conduction better than bone conduction on the left. Weber's test was referred to the left. Roentgenograms of the skull were negative for fracture. The Wassermann reaction of the blood was negative. A post-traumatic neurosis developed, and the patient did not return to work.

TABLE 1—Results of Exam

Case No	Time Elapsed Between Injury and Examination	Auditory Impairment	Spontaneous Phenomena			Nystagmus					
						Rotatory		Caloric			
			Nystagmus	Station	Past Pointing	After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back
(1) County	4 mo	Marked on left side, of inner ear type	Rotary to left especially with head back	Good	None	20 sec onds' duration, poor amplitude	35 sec onds' duration, poor amplitude	Appeared after 1 min 45 sec, faint	Appeared after 2 min 10 sec, faint	Pervverted, i e, vertical instead of horizontal	Good amplitude
(2) C 16	16 mo	Moderate on right, of inner ear type	None	Slight general swaying	To right with both arms	12 sec onds' duration very poor amplitude	10 sec onds' duration very poor amplitude	None	None	None	Good amplitude
(3) C 35	3½ mo	Moderate on both sides, of inner ear type	None	Slight general swaying	3 inches to right with left arm	12 sec onds' duration, very poor amplitude	11½ sec onds' duration, very poor amplitude	None	None	None	Poor amplitude
(4) C 48	10 mo	Moderate on both sides, of mixed inner and middle ear type	None	Good	None	23 sec onds' duration, good amplitude	20 sec onds' duration, good amplitude	None	None	Poor	None
(5) C 38	5 wk	Very slight on both sides, of inner ear type	None	Good	None	14 sec onds' duration, fair amplitude	11 sec onds' duration, fair amplitude	None	None	None	None
(6) C 0	5 mo	Complete on right and moderate on left, of inner ear type	None	Tell toward right ear with head all positions	Slightly to right with both arms	5 sec onds' duration, poor amplitude	6 sec onds' duration, poor amplitude	None	None	None	Good amplitude
(7) C 60	10 mo	Middle ear type on right plus moderate inner ear type on both sides	None	Good	None	22 sec onds' duration, good amplitude	27 sec onds' duration, good amplitude	Appeared after 40 sec, good amplitude	Appeared after 40 sec, good amplitude	Good amplitude	Good amplitude
(8) C 66	9 mo	Unsatisfactory marked on both sides, of inner ear type	None	Good	None	None	None	None	None	None	None
(9) C 65	9 wk	Marked middle ear type on right plus moderate inner ear type both sides	Small horizontal on looking to right	Good	None	14 sec onds' duration, poor amplitude	20 sec onds' duration, good amplitude	None	None	Good	Good amplitude
(10) C 64½	20 mo	Moderate on both sides, of inner ear type	None	Good	None	21 sec onds' duration, poor amplitude	22 sec onds' duration, poor amplitude	None	None	Poor amplitude	Poor amplitude
(11) C 63	26 mo	Slight in left ear, mixed middle and inner ear type	None	Good	To left with left arm	18 sec onds' duration, poor amplitude	22½ sec onds' duration, poor amplitude	Appeared after 25 sec, hyperactive, good amplitude	Appeared after 25 sec, hyperactive, good amplitude	Good amplitude	Good amplitude

Past Pointing						Constitutional Symptoms	Summary
After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back		
Crossed in left arm, i.e., points to left instead of right	Crossed in left arm, i.e., points to right instead of left	Within normal limits	Within normal limits	Within normal limits	Within normal limits	Slight from right ear, more from left ear	Spontaneous nystagmus, crossed past pointing in left arm, perverted nystagmus from right horizontal canal after douching
Crossed in left arm	Absent in left arm, crossed in right arm	Practically absent in both arms	Practically absent in both arms	Practically absent in both arms	Within normal limits	Absent except from horizontal canal	Neuro otologic picture characteristic of angle tumor, except for auditory impairment which was on opposite side, basilar fracture
Prolonged in right arm, crossed in left arm	Crossed in right arm	Subnormal	Subnormal	Subnormal	Normal	Absent	Same as no 2, except that there was no auditory impairment, slow on top of head, 4+ Wassermann reaction
Absent in both arms	Absent in both arms	Subnormal	Practically absent in both arms	Practically absent in both arms	Practically absent in both arms	Absent	Practically same as nos 2 and 3, no past pointing
?	?	Practically absent in both arms	Absent in both arms	?	Within normal limits	Absent	Steeple jack, poor cooperation, labyrinth nonresponsive to douching
Practically absent	Practically absent	Practically absent in both arms	Practically absent in both arms	Subnormal	Within normal limits	Absent	Same as nos 2, 3 and 4, auditory and vestibular apparently out, except some past pointing and nystagmus after douching left horizontal canal
Crossed in left arm	Shortened	Crossed in left arm	Absent in right arm	Normal	Absent in right arm	Slight	Abnormalities in past pointing of doubtful value
Absent	Absent	Absent in both arms	Absent in both arms	Absent in both arms	Absent in both arms	Absent	Nonresponsive labyrinth on both sides
?	?	Subnormal	Absent in right arm	Absent in both arms	Absent in both arms	Present	
Within normal limits	Crossed in left arm	Practically absent in both arms	Practically absent in both arms	Practically absent in both arms	Practically absent in both arms	Absent	Abnormalities in past pointing, no responses from vertical canals
Not done on account of nausea	Not done on account of nausea	Practically absent in right arm	Absent in both arms	Within normal limits	Wide with both arms	Marked	Hyperactive responses, abnormalities in past pointing in right arm after douching, marked constitutional symptoms

TABLE 1—Results of Examinations

Case No	Time Elapsed Between Injury and Examination	Auditory Impairment	Spontaneous Phenomena			Nystagmus					
			Nystagmus		Station	Rotatory		Caloric			
						After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back
(12) C 47	3 mo	Marked on right, of middle ear type, perforated drum on this side	None	Good	None	30 sec onds duration good am plitude	28 sec onds duration, good am plitude	Appeared after 1 min 10 sec, good am plitude	None	Perverted, i. e., oblique to left instead of horizontal	Good am plitude
(13) C 44	9 days	No impairment of inner ear function, slight on left middle ear type	None	Good	None	26 sec onds duration fair am plitude	26 sec onds duration, fair am plitude	Appeared after 35 sec good amplitude	Appeared after 70 sec good amplitude	Good am plitude	Good am plitude
(14) C 43	8 w	Marked on left, of inner ear type	None	?	To right with right arm to left with left arm	21 sec onds' duration good am plitude	23 sec onds' duration, good am plitude	None	Appeared after 1 min, very slow	Good am plitude extremely slow	Good am plitude extremely slow
(15) C 42	12 mo	Slight on right, of middle ear type complete on left, of inner ear type	None	Good	None	23 sec onds duration, poor am plitude	23 sec onds' duration, poor am plitude	Appeared after 30 sec, good amplitude	Appeared after 30 sec poor amplitude	Good am plitude	Good am plitude
(16) C 30	30 days	None	None	Tended to fall back ward with head on either shoulder	To left with both arms	26 sec onds duration good am plitude	27 sec onds duration, good am plitude	Appeared after 1 min 15 sec, poor am plitude	None	Good am plitude	Poor am plitude
(17) C 21	2 yr	?	Horizontal to both sides greater to left	Fell back and to left	To left with right arm	0 sec onds duration good am plitude	30 sec onds' duration, good am plitude	None	Appeared after 45 sec good amplitude	Good am plitude	Good am plitude
(18) C 20	12 mo	Slight on both sides, of inner ear type	None	None	None	20 sec onds' duration, atypical due to paralysis of eye muscle	12 sec onds' duration, atypical due to paralysis of eye muscle	Appeared after 30 sec good amplitude	Appeared after 35 sec good amplitude	Good am plitude	Good am plitude
(19) C 17	4½ mo	Complete on left	?	?	?	19 sec onds' duration, poor am plitude	15 sec onds duration poor am plitude	None	Appeared after 70 sec, fair amplitude	Poor am plitude	Good am plitude
(20) C 11	2 yr	Complete on right side	Large horizontal to left on looking to left	?	None	Patient confined to his bed		None	Fair am plitude	None	Good am plitude
(21) C 9	8 mo	None	Rotary to right on looking up	General swaying	None	16 sec onds duration good am plitude, but slow	25 sec onds duration good am plitude, rapid	Appeared after 30 sec, good amplitude	Appeared after 55 sec good amplitude	?	?
(22) C 6	7 mo	None	None	?	None	21 sec onds duration fair am plitude	10 sec onds' duration poor am plitude	None	None	None	Good am plitude

in Thirty Cases—Continued

Past Pointing							Summary
After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back	Constitutional Symptoms	
Shortened	Within normal limits	Absent in both arms	Absent in right arm	Absent in both arms	Absent in right arm	Absent from right ear, present from left ear	Absent past pointing in right arm, both ears
Within normal limits	Shortened in right arm	?	Absent in right arm	Absent in left arm	Absent in right arm	Present, marked	Practically normal except for abnormalities in past pointing in right arm
Shortened	Shortened	Absent in both arms	Absent in right arm	Absent in right arm, crossed in left arm	Normal	Absent	Right vertical canal nonfunctioning after douching, abnormal past pointing
Shortened in left arm, absent in right arm	Crossed in right arm, shortened in left arm	Present	Present	Exaggerated in right arm	Practically absent in both arms	Absent	Marked auditory, slight vestibular impairment on left side, abnormality in absent past pointing from left horizontal canal after douching
Absent i.e., does not change the spontaneous past pointing	Absent in right arm, prolonged in left arm	Absent in both arms	Absent in both arms	Absent in both arms	Absent in both arms	Absent	Practically no change in spontaneous past pointing even in presence of nystagmus and motion sensing
Absent	Absent in right arm	Absent	Absent	Absent	Absent	Absent	Right vertical nonresponsive to douching, practically no past pointing from other active canals constitutional symptoms absent
Absent in left arm	Crossed in right arm	Crossed in left arm	Crossed in right arm	Crossed in left arm	Absent in right arm	?	Active nystagmus abnormal past pointing
?	?	Absent in left arm	Absent in right arm	Absent in right arm	Absent in right arm	Absent	
Patient confined to his bed		?	?	?	?	Absent	No response from right auditory or vestibular apparatus
Absent in left arm	Crossed in right arm shortened in left arm	?	?	?	?	Marked	Tests not completed on account of vomiting, hyperactive responses, abnormalities in past pointing
?	?	Absent in both arms	Absent in both arms	Absent in both arms	Absent in both arms	Absent	Right side nonresponsive left vertical canals out, angle tumor

TABLE 1—Results of Examinations

Case No	Time Elapsed Between Injury and Examination	Auditory Impairment	Spontaneous Phenomena			Nystagmus					
						Rotatory		Caloric			
			Nystagmus	Station	Post Pointing	After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back
(23) C 51	12 mo	Moderate on right, of inner and middle ear type same on left, but less marked	Horizontal to right on looking to right	Tended to fall toward right ear with head in all positions	To right with right arm	22 sec onds' duration, good amplitude	17 sec onds' duration, fair amplitude	None	None	Small amplitude	None
(24) C 26	4 mo	Marked on right, of middle and inner ear type, middle ear type on left	Large horizontal to left	General swaying	Slight to left with left arm	11 sec onds' duration, good amplitude	10 sec onds' duration, fair amplitude	None	Appeared after 1 min 15 sec, fair amplitude	None	Good amplitude
(25) C 64	12 mo	Moderate on left, of middle ear type	None	Good	To left with left arm	21 sec onds' duration, good amplitude, slow	21 sec onds' duration, good amplitude, slow	None	None	Fair amplitude	Good amplitude
(26) C 65½	4 mo	Marked on both sides, of inner ear type	None	Good	None	34 sec onds' duration, good amplitude	20 sec onds' duration, fair amplitude	Appeared after 45 sec good amplitude	Appeared after 30 sec good amplitude	Good amplitude	Good amplitude
(27) C 66	6 mo	Moderate on right, of middle ear type	Horizontal to right on looking to right	Fell toward left ear with head in all positions	To left with right arm	9 sec onds' duration, poor amplitude	9 sec onds' duration, poor amplitude	None	None	Good amplitude	None
(28) County	6 wk		None	Fell to right with head in all positions	None	35 sec onds' duration, fair amplitude	36 sec onds' duration, good amplitude	None	Appeared after 45 sec good amplitude	None	Good amplitude
(29) County	3 mo	?	None	None	None	12 sec onds' duration, poor amplitude	12 sec onds' duration, poor amplitude	Appeared after 45 sec	Appeared after 55 sec, perverted in type, i.e., oblique to right instead of rotary to right	Good amplitude	Good amplitude
(30)	19 mo	Complete on right, conductive type	Rotary to both sides, small	Fell to right	To right with right arm	7½ sec onds' duration, very small amplitude, rapid	7½ sec onds' duration, very small amplitude, rapid	None	None	None	Good amplitude

in Thirty Cases—Continued

Past Pointing						Constitutional Symptoms	Summary
After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back		
Within normal limits	Shortened in right arm	Absent in both arms	Absent in both arms	Absent	Absent	Absent	Angle tumor picture, with exception of auditory picture
Practically absent in right arm, crossed in left arm	Shortened in both arms	Absent in both arms	Within normal limits	Absent	Within normal limits	Absent from right ear, present from left ear	Right side nonfunctioning
Exaggerated in right arm, practically absent in left arm	Absent in right arm, shortened in left arm	Absent in both arms	Subnormal	Subnormal	Practically absent	Present from left ear	Absent responses from vertical canals, abnormalities in past pointing
Not reliable	Not reliable	Absent in right arm	Absent in right arm	Crossed in left arm	Normal	Present	Hyperactive responses from left side, abnormalities in past pointing
Practically absent in right arm, crossed in left arm	Shortened in both arms	Practically absent in right arm	Practically absent in both arms	Absent in right arm, subnormal in left arm	Absent	Absent	No responses from left side, abnormalities in past pointing, angle tumor picture left, except for auditory impairment
Slightly shortened in both arms	Shortened in left arm	Crossed in both arms	Normal	Slightly subnormal	Absent	Present from right ear	No nystagmus after douching right ear, abnormalities in past pointing from left side with normal nystagmus
?	?	Subnormal	Subnormal	Crossed in right arm, absent in left arm	Within normal limits	Present	Perverted responses from left vertical canals, no skull fracture, Wassermann reaction negative (blood and spinal fluid), vertigo came on 4 days after accident, diagnosis concussion
Shortened in both arms	Shortened in right arm, absent in left	Practically absent	Practically absent	Practically absent	Practically absent	Absent	Cerebellopontile angle syndrome without typical auditory observations

On July 15, 1927, the auditory test showed receptive type of lesion on both sides, more marked on the right, the vestibular test spontaneous, horizontal nystagmus to the left, all of the canals nonresponsive on the right side, hyperactive responses on the left side

CASE 25 (C-64) —*Concussion, neurosis*—A man, aged 65, a foreman, was referred by his employer on Aug 25, 1927 On Aug 18, 1926, he was struck on the left side of the head by a lumber carrier and was rendered unconscious for a few hours There probably had been bleeding from the left ear A year later he complained of occipital headache and dizziness The dizziness was so marked that he was unable to ride in an elevator or on moving vehicles He complained of constant tinnitus in the left ear, like the "ringing of bells" He also complained of deafness on the left side Neurologic examination, made on Aug 25, 1927 gave negative results, save for deafness of the left ear Roentgenograms of the skull showed no fracture, but revealed a fracture of the jaw, as well as of the left transverse process of the seventh cervical vertebra

On August 29, the auditory test showed left-sided impairment, conductive type of lesion, the vestibular test the vertical canals failed to respond to douching, past pointing practically absent

CASE 26 (C-65½) —*Concussion, intracranial hemorrhage, left, right hemiplegia and aphasia*—A man, aged 46, a laborer, was referred by Dr W T Cade, Jr, on May 12, 1927 He was injured on April 7, 1927, when he was struck on the left side of the head by a guy rope under tension He was unconscious for two hours and right-sided hemiplegia and aphasia developed Neurologic examination, made on May 12, showed residual aphasia and right hemiparesis Operation for removal of the clot was refused Roentgenograms of the skull failed to reveal a fracture The Wassermann reaction of the blood was negative He was observed for a period of two years and ten months, during which time he did not return to work

On Sept 14, 1927, the auditory test showed bilateral receptive type of lesion, the vestibular test responses within normal limits, except for abnormalities in past pointing

CASE 27 (C-66) —*Linear fracture of the left temporal region, concussion and contusion of the brain, left facial paralysis*—A man, aged 46, a tree trimmer, was referred by Dr W M Briggs on March 20, 1927 On March 10, 1927, he fell from a tree, striking the concrete He was immediately rendered unconscious and remained so for four days There was bleeding from the left ear, and on the following day left peripheral facial paralysis developed He had been deaf in the right ear for twenty-five years previously, and there was an old perforation of the drum on this side He complained of headaches and dizziness for more than a year following his accident Neurologic examination, made on March 20, gave negative results, except for the left peripheral facial paralysis There was bleeding from the left ear The paralysis of the face cleared up in three months A year later he still complained of headaches and dizziness Roentgenograms of the skull showed a linear fracture in the left temporal region The Wassermann reaction of the blood was negative

On September 26, the auditory test showed conductive type of lesion on the right, the vestibular test responses absent from the left side, the horizontal canal functioned only on the right side

CASE 28 (County) —*Concussion and contusion of the brain, fracture of the skull*—A man, aged 35, a laborer, was admitted to the Los Angeles General Hospital on March 18, 1927 On Feb 26, 1927, he was knocked down by a taxi, being

rendered unconscious and remaining so for twenty-four hours. Three weeks later, his principal symptoms were headaches and dizziness. Neurologic examination at this time showed unsteadiness of gait with a tendency to fall to the right, increase of the deep reflexes and a double positive ankle clonus, but otherwise it gave negative results. Roentgenograms of the skull showed a linear fracture in the right parietofrontal region.

On March 31, the auditory test was not done, the vestibular test showed responses absent on the right side, normal on the left side, abnormalities in past pointing from both sides.

CASE 29 (County) —*Concussion (?)* —A woman, aged 25, a hospital attendant, was admitted to the Los Angeles General Hospital on Sept 20, 1926. On Sept 11, 1926, while riding on a roller coaster, she struck her head, but was not rendered unconscious. She worked for the next two days, when she was forced to stop because of headache and dizziness. Three months after the injury she still had headache and dizziness. Neurologic examination showed moderate internal squint of the right eye, greatly exaggerated deep reflexes, the reflexes being quicker on the right than on the left, and a suggestive Babinski sign on both sides, but otherwise gave negative results. Roentgenograms of the skull were negative for fracture. The Wassermann reaction of the blood was negative. An examination of the spinal fluid made three weeks after the injury, showed a clear fluid under increased tension, but otherwise gave normal results.

On December 9, the auditory test was not done, the vestibular test showed perverted nystagmus from the left vertical canals, abnormalities in past pointing.

CASE 30 (C-30) —*Probable concussion* —The patient was first seen nineteen months after an injury to the skull, complaining of deafness and vertigo.

The auditory test showed complete deafness on the right side, a conductive type of lesion, the vestibular test spontaneous rotatory nystagmus to each side, spontaneous falling to the right, spontaneous past pointing to the right, typical vestibulo-auditory picture of cerebellopontile angle lesion, i. e., the horizontal canal was the only one functioning on the left side.

RÉSUMÉ OF RECHECKED CASE REPORTS

CASE 1 (C-3) —*Concussion* —A man, aged 61, a laborer, who was referred by Dr. John D. Gillis, was injured on March 18, 1925, when he fell 5 feet. He was rendered unconscious, and remained so for a few hours. There was an abrasion back of the left mastoid region. No bleeding from the ears was mentioned. Six months later his principal complaints were headache and dizziness. Neurologic examination, made on September 10, gave essentially negative results. Roentgenograms of the skull were negative for fracture. The dizziness was as marked a year after the injury as at any time during the year.

On Sept 10, 1925, Dec 4, 1925, March 17, 1926, Aug 3, 1926, Nov 17, 1926, and April 6, 1927, the auditory test showed complete deafness on the left side, the vestibular test delayed responses from the left horizontal canal, delayed nystagmus from the left vertical canals and perverted nystagmus from the left horizontal canal after douching, abnormalities in past pointing. On reexaminations extending over a period of a year, the responses from the left set of canals was found to have disappeared.

CASE 2 (C-50) —*Concussion* —A man, aged 48, a grader, was referred by Dr. W. T. Cade, Jr., on Jan 10, 1927. He was injured in an automobile collision on Nov 27, 1926, when he was rendered unconscious for a few minutes. He received a laceration of the right temple, but there was no bleeding from either ear. At

TABLE 2—Results of Exam

Case No	Time Elapsed Between Injury and Examination	Auditory Impairment	Nystagmus								
			Spontaneous Phenomena			Rotatory		Caloric			
			Nystagmus	Station	Past Pointing	After Turning to Right	After Turning to Left	After Douching, Right Ear, Head Up	After Douching, Left Ear, Head Up	After Douching, Right Ear, Head Back	After Douching, Left Ear, Head Back
1 C 3	(Dias) 6 mo	Complete on left side, of middle and inner ear type, marked on right side, of middle and inner ear type	None	Fell to left	To right with right arm (3 in), to left with left arm (5 in)	25 sec onds' duration, fair amplitude	16½ sec onds' duration, fair amplitude	Appeared after 45 sec, good amplitude	Appeared after 2 min, very poor	Good amplitude	Perverted poor amplitude
	9 mo	Bone conduction returning on right side indicating some return in inner ear function still absent in left ear	None	Fell to left	To right with right arm (3 in), to left with left arm (1 in)	15 sec onds' duration, fair amplitude	15 sec onds' duration, fair to good amplitude	Good amplitude	Absent	Good amplitude	None
	1 yr	About the same as last visit	None	Fell to left	Same as when last examined	14 sec onds' duration, fair amplitude	16 sec onds' duration, fair to good amplitude	Appeared after 40 sec, good amplitude	Absent	Good amplitude	None
2 C 50	(Southard) 1 yr 2 mo	Moderate on both sides, inner ear type worse on right	Slight rotary to the left	Moderate swaying	To right with left arm (3 in)	38 sec onds' duration, good amplitude	40 sec onds' duration, good amplitude	Appeared after 1 min 30 sec, good amplitude	Appeared after 35 sec, good amplitude	Fair amplitude	Good amplitude
	1 yr 5 mo	No change since last visit	None	Moderate swaying	Practically none	28 sec onds' duration, poor amplitude	35 sec onds' duration, fair amplitude	Appeared after 2 min 26 sec, very poor, practically absent	Appeared after 1 min, very poor, practically absent	Very small	Good amplitude
	1 yr 7 mo	No change since last visit	None	General swaying	None	32 sec onds' duration, fair amplitude	38 sec onds' duration, fair amplitude	Appeared after 2 min fair amplitude	Appeared after 51 sec fair amplitude	Good amplitude	Good amplitude
3 C 59	(Saueressig) 1 mo	Mixed middle and inner ear type, approximately equal on the two sides	Horizontal to right and left, respectively	Tendency to fall forward	To left with both arms	27 sec onds' duration, good amplitude	28 sec onds' duration, good amplitude	Appeared after 20 sec, good amplitude	Appeared after 60 sec good amplitude	Good amplitude	Not taken
	6 mo	Rather marked decrease with tuning forks	Doubtful	Fairly good	Practically absent	22 sec onds' duration, small amplitude	29 sec onds' duration, good amplitude	Absent	Absent	Very small	Very small
4 C 56	(Littlefield) 3 mo	No perception of tuning forks on left bone conduction slightly shortened on right	None	Good	Doubtful	27 sec onds' duration, good amplitude	17 sec onds' duration, good amplitude	Appeared after 45 sec good amplitude	Appeared after 2 min 30 sec, good amplitude	Good amplitude	Good amplitude
	6 mo	Marked decrease in inner ear function on right side. Continued absence of function on left	Doubtful	Good	Doubtful	12 sec onds' duration, poor amplitude	16½ sec onds' duration, poor amplitude	Appeared after 60 sec poor amplitude	Appeared after 60 sec poor amplitude	Good amplitude	Good amplitude

mations on Cases Rechecked

Past Pointing							Summary
After Turning to Right ?	After Turning to Left ?	After Douching Right Ear, Head Up Normal in right arm, absent in left arm	After Douching Left Ear, Head Up Absent in right arm, normal in left arm	After Douching Right Ear, Head Back Somewhat exaggerated in both arms	After Douching Left Ear, Head Back Within normal limits	Constitutional Symptoms Absent	
Normal in right arm, absent in left arm	Within normal limits	Normal in right arm, subnormal in left arm	Absent in both arms	Within normal limits	Absent	Absent	Bilateral auditory impairment apparently complete on left side, of inner ear type, left vestibular organ gave no nystagmus from vertical canals, perverted nystagmus from horizontal canals, responses somewhat exaggerated from right ear Some return of auditory function on right
Exaggerated in right arm, crossed in left arm	Crossed in left arm	Normal in right arm, absent in left arm	Absent in both arms	Absent in left arm	Absent	Absent	Responses were all practically the same as when examined 3 months previously, staggering, vertigo and deafness continued the same
Very exaggerated	Very exaggerated	Subnormal in right arm	Subnormal	Absent in right arm	Exaggerated in left arm	Moderate on right	Spontaneous nystagmus with hyperactive responses on left side
Slightly exaggerated	Within normal limits	Absent	Absent	Within normal limits	Within normal limits	Slight	Spontaneous nystagmus gone, irritability of vertical canal, responses diminishing
Prolonged, crossed in left arm	Within normal limits	Subnormal	Subnormal	Within normal limits	Within normal limits	Slight	No change from last examination, picture changed from hyperirritability to hypo irritability
Within normal limits	Within normal limits	Subnormal	Not taken	Practically absent	Not taken	Marked from both sides	Moderate hyperactive responses, especially on right side in presence of absent past pointing
Within normal limits	Within normal limits	Practically absent	Practically absent	Absent	Absent	Absent	Marked decrease in auditory function over period of six months, nystagmus hyperactive at first, responses markedly hypo active after six months
Shortened in right arm, absent in left arm	Within normal limits	Subnormal	Practically absent	Practically absent	Crossed in both arms	Absent	Auditory function impaired on left, vestibular function impaired on same side, abnormalities in past pointing
Much shortened in both arms	Prolonged in both arms	Absent	Absent	Absent	Absent	Absent	In presence of marked improvement in subjective symptoms, i.e., decrease in vertigo, the patient showed a marked decrease in auditory and vestibular function

TABLE 2—Results of Examination

Case No	Time Elapsed Between Injury and Examination	Auditory Impairment	Spontaneous Phenomena			Nystagmus					
			Nystagmus	Sit on	Past Pointing	Rotatory		Caloric			
						After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back
5	(Lyle)	Mixed middle and inner ear type on right, moderate	None	Good	None	1½ sec onds' duration good amplitude	16 sec onds' duration good amplitude	Appeared after 45 sec fair amplitude	Appeared after 15 sec fair amplitude	Good amplitude	Good amplitude
C 67	2 mo										
	5 mo	Improved on right side	None	Good	None	1½ sec onds' duration good amplitude	15 sec onds' duration good amplitude	Practically absent	Appeared after 1 min 10 sec small amplitude	Good amplitude	Good amplitude
6	(Sci graves)	Complete of inner ear type on right, moderate on left of middle and inner ear type	None	✓	To right with right arm (4 in), touched with the left arm	19 sec onds' duration good amplitude	11½ sec onds' duration fair amplitude	Absent	Appeared after 2 min very small amplitude	Absent	Good amplitude
C 2	4 mo										
	1 yr 3 mo	Tuning fork tests indicate no improvement heard spoken voice better on both sides	None	✓	To right with right arm (2 in) to right with left arm (2 in)	18 sec onds' duration good amplitude	18 sec onds' duration good amplitude	Absent	Appeared at end of 1 min 30 sec good amplitude	Absent	Good amplitude
	1 yr 9 mo	Marked impairment in left to spoken voice, moderate impairment on the right side	None	None	None	18 sec onds' duration good amplitude	15 sec onds' duration good amplitude	Absent	Appeared at end of 1 min 30 sec good amplitude	Absent	Good amplitude

the end of two weeks, he tried to work, but was obliged to stop because of dizziness. The dizziness increased during the next five months. At times he was nauseated and would vomit, and during his attacks of vertigo he staggered toward the right. Neurologic examination revealed the right pupil to be larger than the left, the Romberg sign was positive, his gait was unsteady and he reeled toward the right otherwise the results were negative. Roentgenograms of the skull showed no fracture. The Wassermann reaction of the blood was negative.

On January 12 and on March 9, the auditory test showed moderate impairment, bilateral, receptive lesion, more marked on the right side, the vestibular test slight spontaneous nystagmus to the left, hyperactive responses from the horizontal canals after turning, hyperactive responses from the left labyrinth after douching, abnormalities in past pointing. Reexamination five months later showed delayed responses from the right vertical canals after douching. The picture had changed from one of hyperirritability to one of hypo-irritability.

CASE 3 (C-59)—*Concussion*—A man, aged 71, a carpenter, was referred by Dr. W. T. Cade, Jr., on June 27, 1927. On March 21, 1927, he was struck on the head by a piece of falling timber. He was not rendered unconscious, but stated that there was a terrific noise in his head. There was no bleeding from either ear. Two days later he complained of headache and dizziness, which continued for many months. He had a violent ringing in the right ear and a screeching sound in the left. For many years he had been "hard of hearing." Neuro-

Past Pointing							Summative
After Turning to Right	After Turning to Left	After Douching Right Ear, Head Up	After Douching Left Ear, Head Up	After Douching Right Ear, Head Back	After Douching Left Ear, Head Back	Constitutional Symptoms	
Shortened in both arms	Shortened in both arms	Absent	Absent	Absent	Absent	Absent	Abnormalities in past pointing in presence of active nystagmus
Shortened in right arm, absent in left arm	Absent in both arms	Absent	Absent	Absent	Absent	Absent	Subjectively improved in regards to vertigo and hearing, objectively, some improvement in hearing on right side, past pointing absent from the first, nystagmus after douching hyperactive on right at first, disappeared on second examination
?	?	Absent in both arms	Within normal limits (3 and 3)	Absent in both arms	Within normal limits	Absent from right side, slight from left side	Right vestibular and cochlear impairment
Slightly subnormal in both arms	Shortened in right arm, absent in left arm	Practically absent in both arms	Absent in right arm subnormal in left arm	Crossed in both arms	Absent in left arm crossed in right arm		Slight improvement in auditory function on both sides right vestibular apparatus still failed to respond
Within normal limits	Within normal limits	Absent in both arms	?	Absent in both arms	Within normal limits	Absent	Five months later showed practically same picture in regard to vestibular function, subjectively much improved, had had no attacks of vertigo for three weeks prior to last examination

logic examination gave negative results. The patient showed advanced senile changes incident to his age. Roentgenograms of the skull showed no fracture. The Wassermann reaction of the blood was negative. For a period of fourteen months his symptoms continued unabated, and he was totally incapacitated.

On Aug 18, 1927, Nov 7, 1927, and July 7, 1928, the auditory test showed bilateral impairment, mixed conductive and receptive type of lesion, the vestibular test when first examined, vestibular responses were hyperactive, with spontaneous, horizontal nystagmus to the right, five months later they were hypo-active, i. e., no nystagmus from the vertical canals after douching. Past pointing had disappeared at a subsequent examination.

CASE 4 (C-56) —*Concussion and contusion of the brain, linear fracture of the left temporal bone*—A man, aged 32, a laborer, was referred by Dr. George W. Jones on July 10, 1928. On Feb 22, 1927, he fell 15 feet, striking the left side of his head on some brick. He was rendered unconscious, remaining so for about two weeks. There was profuse bleeding from the left ear. Six months later he complained of deafness in the left ear, ringing in the left ear, occasional headache, dizziness, forgetfulness, confusion and irritability. Neurologic examination at this time showed irregular pupils, impairment of hearing in the left ear and a fine tremor of both hands in attempting coordination tests but otherwise gave negative results. Roentgenograms of the skull revealed a linear fracture in the left temporal region.

On May 20 and October 21, the auditory test showed no perception of sound on the left side, the vestibular test reduced responses from the right horizontal canal after turning, abnormalities in past pointing throughout, responses from the left vertical canals much delayed after douching. The vestibular reactions were much more hypo-active on reexamination six months later.

CASE 5 (C-67) —*Concussion, basal fracture of the skull*—A man, aged 24, a lather, was referred by Dr J Rollin French on Oct 17, 1927. He was injured on Aug 18, 1927, when his motorcycle collided with a truck. He was rendered unconscious for ten minutes, and there was bleeding from the right ear. Bell's palsy subsequently developed on the right side. Two months after the injury he complained of faintness and dizzy spells. The dizziness developed about two weeks after the accident, and was accentuated by getting up suddenly or putting the head backward. The patient also complained of constant tinnitus in the right ear, which he described as sounding like "a leak in an air line."

On examination, slight weakness of the right side of the face persisted, although Bell's palsy had practically cleared up. There were a horizontal nystagmus with the quick component to the left when the patient looked toward the left, impairment of hearing on the right with tinnitus in this ear and increased irritability. Roentgenograms of the skull showed a linear fracture in the right parietal region extending into the mastoid cells. The Wassermann reaction of the blood was negative.

On Oct 17, 1927, and Jan 20, 1928, the auditory test showed mixed conductive and receptive type of lesion on the right side, the vestibular test good nystagmus after douching of the right ear, with absent past pointing, hyperactive nystagmus and constitutional symptoms after douching of the left ear, with almost absent past pointing. A second examination three months later showed the picture to be practically the same, except that the vertical canals on the right side were practically nonresponsive to douching.

CASE 6 (C-2) —*Concussion and contusion of the brain, linear fracture of both parietal bones, syphilis*—A man, aged 29, a welder's helper, was referred by Dr W T Cade, Jr, on Aug 21, 1925. On April 21, 1925, he fell 18 feet from a ladder into a tank. He was rendered unconscious, recovering consciousness four hours later. Four months later he complained of constant ringing in the right ear, deafness of the right ear, irritability and deafness. Headache was not marked. There was a previous history of deafness of the left ear. Neurologic examination revealed inequality of the pupils, the right being larger than the left. There was unsteadiness of the eyes on looking to the right and the left. The patient was very deaf in both ears. He swayed in Romberg's position, and at times staggered. The knee reflexes were gone. Roentgenograms of the skull showed a linear fracture in each parietal bone, running toward the external auditory meatus. The Wassermann reaction of the blood was 4 plus. After three years of intensive antisyphilitic treatment, the Wassermann reaction of the blood was 1 plus. His hearing had not improved, although the dizziness was considerably less. He was unable to work.

On Oct 20, 1926, and March 2, 1927, the auditory test showed impairment on the right side, conductive type of lesion, vestibular absent responses from the right side.

CONCLUSIONS

1 In practically all cases of cerebral concussion the patient complains of some form of equilibratory disturbance.

2 The disturbance of equilibration may be demonstrated by some abnormality in the neuro-otological observations

3 These observations are usually indicative of mixed central and end-organ damage rather than involvement of the end-organ alone

4 The most constant observations are abnormalities in the past pointing reactions

5 Traumatic equilibratory disturbances arising in the end-organ are more apt to readjust themselves than are those of central origin

6 Postconcussional vertigo should not be dismissed as psychogenic in origin until it has been checked by neuro-otological tests

7 Postconcussional vestibular tests may entirely, or partially, simulate those found in the syndrome of tumor of the cerebellopontile angle

A NEW TEST FOR BORROWED BONE CONDUCTION¹

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In the study of labyrinthine deafness with the tuning forks I have been confronted several times with the following observations. The patient gives a history of a sudden attack of nausea and vomiting accompanied by intense vertigo and total deafness in one ear. Otitis media and mastoiditis may or may not be present. Spontaneous nystagmus and past pointing may be present if the patient is seen soon enough after the onset of the attack.

Objectively there is a total loss of air conduction in one ear as shown by all tests. When tested for bone conduction by the Weber test the patient frequently refers the sound to the unaffected ear. When the tuning fork is placed over the affected mastoid, however, the patient frequently claims that he perceives the sound with the affected ear. This fact would rule out a dead ear. It is well known that it is difficult to localize sound definitely to one ear, especially when one is not cognizant of the fact that a sound produced at one spot on the skull can be carried to a distant spot by bone conduction. The following simple procedures by varying the intensities of the sound produced, have helped me to clear up some doubtful cases.

Perform a Weber test, frequently the patient localizes the sound in the well ear. Place the 256 double vibration fork over the mastoid of the suspected side; occasionally the patient says that he hears the note on the affected side. In order to test whether or not this conduction is borrowed, create an artificial total obstruction on the affected side by closing the canal with the finger; if one is dealing with labyrinthine deafness and a dead ear, the patient does not notice any difference in the intensity of the sound, but if some hearing remains on that side, the sound is greatly increased.

In order to check up on this observation, remove the obstruction from the affected canal, and close the canal of the unaffected ear with the finger. The patient immediately notices a change in the intensity of the sound, and sometimes he even says that he hears the sound in the unaffected ear. Place the fork over the well mastoid, if the patient hears the sound with the unaffected ear, close the external auditory canal of the affected ear with the finger. The patient should notice no difference in the sound, whereas the closing of the canal of the unaffected ear magnifies the sound greatly.

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* Read before the Philadelphia Laryngological Society, Feb. 3, 1931.

With the results stated, one can be practically certain that despite the patient's statements to the contrary, all the sounds carried by bone conduction are being heard by the unaffected ear. Of course, confirmatory Bárány tests would help to establish the diagnosis. The procedure outlined should be of especial value in central deafness with involvement of the auditory nucleus or of the cochlear portion of the eighth nerve when the vestibular apparatus is unaffected.

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OTOSCLEROSIS

STAINING AND CHEMICAL REACTIONS *

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The peculiar staining reactions of the foci in otosclerosis have long attracted attention. Various ideas have been expressed to explain the striking bluish-red appearance such as occurs with the hematoxylin-eosin stain. A number of investigators have attributed the bluish reaction to the presence of calcium. It has been supposed that the focus has so great a content of calcium that even after decalcification some of it would still be present and would show on staining with hematoxylin. The blue staining has also been thought to be due to the peculiar chemical characteristics of the ground or cement substance in the foci. Just what the chemistry of this is does not appear to be known. Another view is that the increased supply of blood and lymph to the focus produces the blue stain. It is also believed that the pink-staining tissue usually found just underneath the osteoblasts that line the enlarged marrow spaces is new bone. This bone takes a pink stain and not the blue of the hematoxylin. On the basis of increased calcium being present in the foci, Bruhl fed guinea-pigs madder (alizarin), hoping to produce a redness of the promontory which could be seen through the drum membrane. The results were negative, possibly owing to the lack of intensity of the color reaction. It is noted by many that certain foci do not stain deeply with hematoxylin, but are more reddish. These foci are believed to be of much longer duration. Other stains have been used to characterize the foci, such as van Gieson's, iron hematoxylin and carmine, but explanations as to the underlying cause of the atypical staining reaction have mainly regarded hematoxylin and eosin.

During the course of study of sections of otosclerosis of four temporal bones,¹ I became interested in the possibility of learning more about the staining and chemical reactions of the foci. The material at hand consisted of four bones showing otosclerosis.

1 Bone T was from a woman, aged 37, who had no previous history of aural infection, but who died following an acute infection of the temporal bone, with intracranial complications. The affected ear (the other ear was not obtained) revealed a focus in the "site of predilection."

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* Presented as candidate's thesis to the American Laryngological, Rhinological and Otological Society

1 Hagens E W. Otosclerosis, Arch Otolaryng **12** 273 (Sept) 1930

2 and 3 Bone Fe (right) and Bone Fe (left) were from a woman, aged 20, who had had a chronic discharge from the left ear for eighteen years following scarlet fever. Only slight deafness had been noted in this ear, and the other ear presumably was normal. The patient died following an acute suppuration in the left ear, which was associated with intracranial complications. On sectioning, both ears showed multiple foci of otosclerosis, although no such diagnosis had been made during life.

4 Bone W (left) was from a man, aged 70, who had been deaf for years. The patient thought that the condition was catarrhal. Dr Shambaugh made a diagnosis of otosclerosis seven years before death. The sections showed a focus at the "site of predilection."

While experimenting on these sections, I found it advisable to use sections of ears not showing otosclerosis from other adult human beings, also sections from infants' ears and pigs' ears and other sections of bone. The results of the tests seemed sufficiently interesting to warrant reporting. The carrying out of the tests was made possible by the suggestions and aid of Dr R. Bensley and Dr G. W. Bartelmez of the University of Chicago.

In the first place, the foci from each of the four bones did not react in the same way. The differences, however, were a matter of degree or lack of reaction. Thus, one focus took the stain strongly, another weakly, while the last two did not show the stain. Just why these results obtained is a question. Difference in technic can hardly be the sole cause, because Fe (right) and Fe (left) showed these differences strikingly and they were from the same patient and were treated alike at all times. The possibility that the age of the focus influenced the staining and chemical reactions is, therefore, to be considered. A greater abundance of otosclerotic material will probably tend to clear up these matters in the future.

EXPERIMENTAL DATA

The sections were stained with a yellow aqueous solution of crystalline hematoxylin. Hematoxylin becomes blue only when it is mordanted with the salts of the heavy metals. The foci in Fe (right) stained a definite blue, the focus in T took a faint, but definite blue, whereas the foci of Fe (left) and W were negative. The stain was taken up by the bony structure of the foci including the bone cells. The marrow spaces with their contained vessels and cells were not stained. The placing of the sections in the stain for twenty-four hours gave the same results. Sections of other temporal bones and long bones were negative. Because of the positive results in the foci of two of the bones, the presence of calcium or of some metallic salt seemed indicated.

Therefore, tests were made with alizarin and purpurin, both of which are used to reveal calcium. The results, however, did not confirm the suspicion that the sections contained calcium. Sections of the four bones, as well as of other temporal bones, and sections of long bones gave negative results. In several sections the foci were more prominent than the surrounding tissue, but close examination showed that this was due to the increased staining reaction of the marrow cells, while the bony framework of the foci was similar to the adjacent bone. When the sections were stained with alizarin for twenty-four hours, the aforementioned results were not altered. With these observations, other causes than calcium were sought.

The sections were treated with ammonium sulphide. Sections of Fe (right) showed a definite green reaction in the foci, while the other sections were entirely negative. The tests were repeated a number of times, but the same results were always obtained. This chemical reaction indicated the presence of iron in the foci of Fe (right). Confirmation of the reaction was carried out by treating the sections with an acid solution of potassium ferriocyanide. Sections so treated showed the definite blue reaction of ferric ferriocyanide or prussian blue in the foci. The foci of Fe (right) showed definitely, in T the reaction was slightly positive, while Fe (left) and W were entirely negative. Thus, the foci of the same two bones that were positive to hematoxylin were positive to the test for iron. It was noted that the distribution of the reaction, that is, the presence of the reaction in the bony framework of the foci and its absence in the marrow spaces and cells, was the same in both the hematoxylin and the iron tests. On reexamination of the sections stained with hematoxylin-eosin, it was seen that the iron-containing foci gave the deeper blue with hematoxylin-eosin.

Modifications of the test for iron were carried out for further information. Treating the sections with potassium ferrocyanide for twenty-four hours instead of for five minutes, in the case of Fe (left) and W, which had not stained with the usual method, showed that the sections as a whole had adsorbed colloidal prussian blue and that the foci were not any more deeply stained than the rest of the tissue. Next, sections of Fe (right) and Fe (left) for control were kept in iron alum for forty-five minutes, thoroughly washed and then treated with potassium ferrocyanide. The sections showed blue as a whole, but the foci were still more blue. This indicated a greater capacity of adsorption of the bone in the foci. Other sections of Fe (left) were then subjected to the iron alum, after which they were placed in 0.5 per cent nitric acid solution, washed and, following this, were treated with potassium ferrocyanide. The results showed the foci still giving the blue reaction, but the acid had removed most of the iron from the rest of the tissue. This indicated an increased capacity of the foci for holding iron. Sections

of Fe (right) were treated for one hour with 0.5 per cent nitric acid and then treated with potassium ferrocyanide. The foci reacted just as when they had not been treated with acid, showing the inability of the acid to remove the iron from the foci in this length of time.

An ear (cochlea) from a full term infant was treated with potassium ferrocyanide and the prussian blue reaction was obtained in the nuclei of the labyrinth (organ of Corti, especially) and at the edges of the bone tissue bordering the marrow spaces in the enchondral bony labyrinth. In the new-born infant, the marrow spaces are prominent and easily seen. Counterstaining with thiazine red was carried out to define further the site of the prussian blue reaction and confirmed the aforementioned observations. A bone from a finger of another new-born infant was also treated and the blue reaction was noted in the bone of the diaphysis close to the cartilaginous junction. Sections of a normal temporal bone from an adult, treated as previously mentioned, gave no reaction.

Staining with toluidine blue was carried out on the otosclerotic sections and the foci of Fe (right), Fe (left) and W were negative for a metachromatic reaction. However, in the sections of T the focus stained a reddish-purple, especially in the anterior part, which was bluest with hematoxylin-eosin and slightly positive with pure hematoxylin and with the test for iron. In all the sections stained with toluidine blue the remnants of cartilage stood out prominently as purplish-red areas.

In order to test the possible action of the alum mordant in the usual hematoxylin-eosin stain, sections of bone T were placed in aluminum ammonium sulphate (alum) for forty-eight hours. Then the sections were stained with hematein. The result showed the focus taking a definite deep blue stain, previously, with pure hematoxylin the focus had stained only slightly better than the surrounding bone. Sections of bone Fe (left) which previously were entirely negative to pure hematoxylin alone also showed the foci taking a deeper blue stain under this treatment. This reaction following the alum was interpreted to mean that the focus adsorbed colloidal aluminum hydroxide which in turn took up the hematein.

COMMENT

From the foregoing experiments several interesting observations are presented. It could not be proved whether calcium as such was present or absent in the foci. Apparently there is no chemical test by which calcium alone can be accurately demonstrated. So far as the tests with alizarin and purpurin were concerned, the reactions were negative. The ammonium sulphide test and the prussian blue reaction proved definitely the presence of iron in bone Fe (right) and T. Thus the blue reaction in the foci of otosclerosis stained with hematoxylin-eosin may be due

to iron. The test in which mordanting with alum was followed by staining with hematein indicated that the affinity of the focus for the colloidal aluminum hydroxide caused the adsorption of the hematoxylin. Thus the focus may take a deep blue stain. This would explain the blue reaction with hematoxylin-eosin seen in the foci of Fe (left) and W, neither of which gave a reaction for iron. In general, it seems that either (1) the presence of iron in a focus or (2) the adsorption of hematoxylin through the medium of the colloidal aluminum hydroxide would account for the peculiar blue reaction with hematoxylin-eosin. Also, both factors may be present in a given focus, one supplementing the other. Thus it is seen that the foci of otosclerosis have a definitely increased adsorptive power for the iron and the aluminum hydroxide which is not possessed by the rest of the bony labyrinth.

The source of the iron in the focus is of interest. It may occur (1) antemortem or (2) postmortem. In the first instance, the pathologic process may have been such that an excess of iron was deposited there. The foci are usually vascular, and it is possible that iron from the blood had been freed and left in this region. It is known, of course, that the iron in the blood cells, as such, cannot be detected. Iron from the tissue cells may also have been freed by the destructive process and may furnish a source for the iron. If the iron was a postmortem affair, it arrived at the focus during the process of preparing the bone for sectioning. The necessity for determining complete decalcification furnishes a likely source for some of the iron. In the future, temporal bones will be run through without the use of the needle test, the x-rays having been found a more satisfactory guide, hence, this source for the iron will be removed and will not need to be considered. Another possibility is that the organically combined iron in the tissues may have been freed by the treatment with acid and adsorbed into the focus. Which of the aforementioned views is correct, it is difficult to say, perhaps several of the factors may be acting together.

The reactions to toluidine blue are of interest, but they are not chemically exact enough to draw conclusions.

I feel that microchemical tests may open an avenue of approach to otosclerosis that may have far-reaching possibilities. Limited material and the difficulty of getting it in a good state of preservation handicap work along this line. Chemical tests that are absolutely positive are much better guides than reactions that are indecisive and that lead to irrational speculation and conclusions.

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DELAYED HEALING FOLLOWING THE SIMPLE OPERATION ON THE MASTOID

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In calling attention to delayed healing following the simple operation on the mastoid I expect to play on a sympathetic cord—that of companions in misery. For to me at least, the experience in treating some of the patients has been trying in the extreme. When I turned to the literature for help or at least consolation I was struck not with the scarcity of articles on the subject but with their almost entire absence.

Although all authors mentioned delayed healing following measles, diphtheria or scarlet fever Kerrison alone referred somewhat in extenso to delayed healing in mastoiditis caused by the usual infecting organisms. I quote the following paragraph from his recent textbook under the title of "Arrested Repair."

A post-operative condition of which I have seen no mention in text books, but with which the surgeon has occasionally to deal is characterized by the abortive type of granulations which line the bone cavity. Post-operative repair seems at first to follow a perfectly normal and favorable course. The bone cavity is soon lined by a layer of firm and apparently healthy granulations. The tympanic condition shows progressive improvement, and within a reasonably short period the drum membrane heals. In the post-auricular wound however the process of repair is arrested. There is little or no pus and in fact no more secretion than is inseparable from a granulating wound. The granulations themselves, though of healthy appearance are stationary. I.e. the process of tissue building seems arrested. Do what we may to increase the local blood supply and thereby stimulate a normal growth of new tissue the aditus remains open and the post-auricular wound persists as a cavity of very considerable size. In my experience this condition—I.e. arrested repair, without evidences of osseous necrosis—is almost invariably an expression of anaemia or of some otherwise lowered constitutional state.

While he did not mention specific methods of after-treatment or efforts to stimulate repair of the wound Kerrison suggested two possible solutions. (1) allowing the edges of the skin to grow into and so ultimately line the cavity of the wound with much resulting disfigurement and (2) the performing of a plastic operation.

TECHNIC OF OPERATION

Before proceeding with the subject in question I should like to mention briefly the method that my associates and I follow at the present

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time in our clinic in the performance and after-treatment of the simple operation on the mastoid

After the usual postauricular incision and removal of the outer cortex, the mastoid process is thoroughly everted until firm cancellous bone is encountered. The dura and sinus are freely uncovered, if the overlying bone is found to be involved. The zygomatic cells are uncapped and drained, and the whole mastoid cavity is thoroughly explored with a bent probe in order that no single cell be overlooked. The angle between the horizontal and the vertical portions above the wall of the sinus receives especial attention, owing to the possibility of overlooking cells in this locality. The antrum is freely opened, its outer wall being completely removed. Great care is taken that no chips of bone find lodgment in the aditus, thereby obstructing drainage from the middle ear. On the completion of the operation, the upper two thirds or three fourths of the wound are completely closed with Michel clamps, only a small opening being left inferiorly for the insertion of a rubber-covered cigaret drain. An end of this drain is carried directly into the antrum. No effort is made to fill the entire mastoid cavity with the drain. A loose wick is placed in the canal, the end in contact with the tympanic membrane.

The wound is dressed the day following the operation, the wick from the canal is removed, and the canal is thoroughly cleansed. On the fourth day, the skin clips and cigaret drain are removed. In case the middle ear is still discharging, the cigaret drain is replaced and the posterior wound kept open until the middle ear is dry.

The almost complete closure of the postauricular incision is a decided departure from our earlier procedure, in which the wound was packed almost completely open with iodoform gauze. We are convinced, however, that our present practice possesses the following marked advantages: 1. The dressing, i. e., the removal and replacement of the drain, is practically painless, as granulations cannot adhere to or grow into the rubber drain. 2. There is an almost complete absence of subsequent deformity, as a rule, only a fine linear scar with no depression remains. 3. There is a marked reduction in the time of convalescence, i. e., healing, with complete cessation of discharge from the middle ear and the wound in the mastoid.

The foregoing method has borne the test of long and favorable experience. I agree with Roberts that antiseptic solutions and packing are without demonstrable influence, and that the packing method of dressing simple wounds in the mastoid, while more certain of thorough and solid healing, prolongs the dressing period and tends toward increasing the deformity. Were it not that delayed healing occurred under both methods of after-treatment, I should be inclined to feel that our present method was possibly at fault in the production of such an unfortunate result as a postauricular fistula or a protracted delay in the healing, which Graham-Brown classified as one of the failures of the operation on the mastoid. But such is not the case, as delayed healing was as much in evidence following the so-called "open" method.

REPORT OF CASES

A brief detail of five cases may be of interest. The first was my earliest, and as I have been unable so far to locate the case history, the recital must be entirely from memory.

CASE 1—The simple operation on the mastoid was followed by a rather stormy course, but ultimately a normal temperature and the discharge of the patient, a child of 10, from the hospital in ten days. The discharge from the ear and that from the wound in the mastoid persisted. There was almost a complete loss of the tympanic membrane and a marked impairment of the hearing. A radical operation was performed on the mastoid at the end of six months, and a favorable result was secured, although there was, of course, no improvement in the hearing.

CASE 2—A school teacher, aged 34, underwent a simple operation on the mastoid. The mastoid was large and pneumatic, and was filled with pus and some granulation tissue. There was little or no breaking down of the structure of the cells. The wound was dressed open. The temperature was normal five days following the operation. The patient was discharged from the hospital on the twelfth day. The ear was dry on the twenty-first day, but the perforation was still open. The wound was apparently healing nicely. At the end of three months, after stimulation of its edges with trichloroacetic acid, the perforation in the anterior inferior quadrant of the membrane had finally closed, but the wound in the mastoid was still open and bare bone could be felt in the posterior part of the mastoid cavity. There was little or no discharge from the wound, and in spite of packing and cauterization of the margins of the wound, the edges continued to grow down into the mastoid cavity. Although the cavity was very large, the edges of the skin after growing down part way started to bridge across the cavity and ultimately closed it, the scar tissue stretching across the underlying space like a drum head. Thus, the posterior wound was healed three and one-half months after operation. The patient complained only of occasional tinnitus. The wound has remained in this condition since, twenty years after the operation, and has caused no trouble or inconvenience.

CASE 3—A returned soldier, aged 21, underwent a simple operation on the mastoid following measles. The mastoid was large and pneumatic. The entire mastoid was filled with pus and granulation tissue. The dura and sinus were bare, the latter was covered with granulations. The wound was packed open. There was an apparently uneventful recovery. The ear was dry on the eighth day. The patient was discharged from the hospital on the tenth day, there was still some discharge from the wound in the mastoid. Healing was extremely slow. The discharge persisted for four months, though the ear was dry. There was an occasional slight rise in temperature. At this time, as bare bone was still felt, the patient was again referred to the hospital, where the mastoid cavity was thoroughly curetted. The wound was packed open. The patient was discharged from the hospital five days later, the ear was still dry. Six months after the original operation, the ear was dry, and there was a slight discharge from the wound in the mastoid and a small sinus leading down to the antrum of the mastoid. The sinus did not heal until eight months after the original operation. The wound had since remained closed, with no subsequent discharge—fourteen years following operation. There was only a slight impairment of hearing. There was a markedly depressed scar.

CASE 4—A physician, aged 55, underwent a simple operation on the mastoid. The mastoid was large and pneumatic, and contained much pus under extreme pressure. There was very little granulation tissue or breaking down of the structure of the cell, with the exception of a perforation through the posterior aspect of the tip into the substance of the sternomastoid muscle. The wound was closed, except for a space for the insertion of a cigaret drain. The usual postoperative treatment was administered, with discharge from the hospital on the ninth day, there was still a discharge from the middle ear and the wound. Three and one-half weeks after the operation, the ear was dry, though there was still some discharge from the wound in the mastoid, then suddenly the patient complained of severe pain and restlessness and showed a slight fever. He was accordingly referred to the hospital, where roentgen examination was made. As this examination showed cells extending into the zygoma, these cells were opened under gas anesthesia, the sinus and dura were uncovered, and the mastoid was thoroughly explored for possible unopened cells. None were found, nor was any pus found in the cells of the zygoma. The patient was discharged from the hospital five days after the second operation. There was still some discharge from the ear and from the wound in the mastoid. The discharge persisted, there was no fever, but there were occasional attacks of severe pain. The sinuses were normal. Three weeks after the patient had left the hospital, there was no fever, but there was an occasional severe pain and a well marked diplopia on looking to the left, the side on which the operation had been performed, in other words, there was a typical Gradenigo symptom complex. This was evidently the cause of the pain when the second operation had been performed on the mastoid, though the diplopia had not developed at that time.

Two months after the operation, there was still a slight discharge from the wound in the ear and in the mastoid, and the diplopia, though decreased, was still present so that the patient could not drive his automobile. Three months after the original operation, the ear was dry, the perforation closed and the wound in the mastoid covered with a thin, tense scar similar to that described in case 2. The diplopia gradually disappeared. The hearing was normal.

CASE 5—A housewife, aged 25, was six months pregnant. She underwent a simple operation on the mastoid. The mastoid was of fair size and pneumatic, and contained much pus and granulation tissue. No difficulty was encountered at the time of operation, except for rather profuse and persistent bleeding from the tip of the mastoid cavity, the sinus lying well forward. Clips were applied to the skin, and a cigaret drain inserted. The patient was discharged from the hospital on the sixth day. The ear was dry, and the perforation had healed, there was some discharge from the wound in the mastoid. Six weeks later, the wound was almost healed and the ear was still dry, though the patient complained of almost constant headache. Examination of the eyes showed some astigmatism. The sinuses were normal.

Two and one-half months after the first operation, following an increase in the discharge from the wound in the mastoid and considerable redness, the patient was again referred to the hospital, where the wound was reopened. The mastoid was thoroughly curetted, no dead bone was found. Clips were applied to the skin, and a cigaret drain inserted. The patient was discharged from the hospital four days later. The discharge from the wound in the mastoid persisted. The baby was born at full term. At that time the ear was dry. A conversational voice could be heard at a distance of 6 meters on the right, and at 4 meters on the left. The tympanic membrane was about normal.

Four months later, the wound in the mastoid, on account of a marked redness, was again opened with the patient under procaine hydrochloride anesthesia. Three months later it was again opened under gas anesthesia, and the dura and sinus were uncovered, the wound was left open and packed with iodoform gauze. During this period, a probe could be freely introduced into the antrum of the mastoid. If the packing was left out, the patient immediately complained of pain, headache, nausea and vomiting.

On February 28, one year and one month after the original operation, the mastoid was again opened under gas anesthesia. The patient at this time complained of headache, nausea, vomiting and severe pain behind the left eye, with inability to read, but no diplopia. At this time the sinus and dura were uncovered more freely, but nothing abnormal was found. A few small cells were found lying posterior to the sinus and a considerable number of cells above the external canal and extending well forward into the zygoma. A portion of the posterior wall of the canal was also removed. The wound was packed open. The discharge continued, the wound healing slowly. The patient otherwise was in excellent health.

At this time, following the suggestion of Fenton, the wound was packed with dichloramine-T in chlorinated paraffin. An attack of tonsillitis was followed by an increase in the discharge, but this subsequently decreased. Six months later, though the packing had been discontinued, there was still a slight mucous discharge from the wound and a small sinus leading down to the antrum. Five months later, or one year and nine months following the original operation, the ear was still dry and the wound in the mastoid had healed. Hearing was normal.

COMMENT AND CONCLUSIONS

1 In a certain proportion of cases of simple operation on the mastoid in acute mastoiditis, healing, owing to causes apparently beyond knowledge and control, will be slow and protracted.

2 In such cases, when the middle ear remains dry, one should turn to the radical operation on the mastoid only as a last resort, on account of the resulting serious impairment of the hearing.

3 In such cases, severe pain may be an indication of the Gradenigo complication, a localized inflammation at the tip of the petrous portion of the temporal bone with involvement of the gasserian ganglion. This would certainly seem to have been the explanation in one of my cases, and is a probable explanation in the last, although the third symptom in the Gradenigo triad, the diplopia, did not develop.

4 In every case of acute mastoiditis all cells should be thoroughly exenterated and subsequently secondary operations resorted to only when urgent symptoms supervene.

5 The ultimate restoration of hearing is a consideration that should always be kept in view. If there is no discharge from the middle ear and the aditus is kept open, the prognosis for the hearing is good.

6 The method of treatment described, as long as sound surgical principles are followed, apparently has no effect in the causation of delayed healing.

ADENOIDECTOMY UNDER LOCAL ANESTHESIA *

ROY F NELSON, M D

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That hypertrophied and infected adenoids (pharyngeal tonsils) may be of importance in adults has been noted ¹

Local anesthesia for tonsillectomy is being more widely used, and that its advantages should be sacrificed when performing adenoidectomies seems wrong. Nevertheless, adenoidectomy under topical anesthesia alone is very painful, it is a shock to any but hardy nerves, and is apt to be incomplete because the surgeon does not wish to punish his patient with the repeated attempts and digital exploration usually required for a thorough operation. I speak from personal experience in three painful operations of this kind, in the first two of which the results were unsatisfactory.

The following technic gives as complete anesthesia for adenoidectomy as has been obtained in tonsillectomy.

METHOD

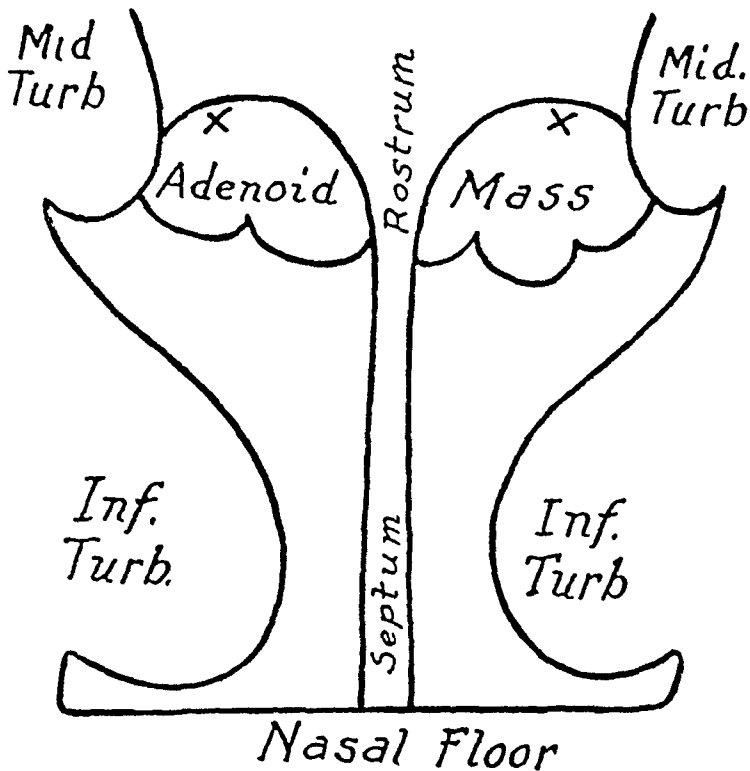
The pharynx is anesthetized as for tonsillectomy. With a curved metal applicator, the nasopharynx is swabbed transorally with cocaine in the strength preferred. The inferior turbinate is shrunk and lightly anesthetized, and the choanal vault and lateral nasal wall behind the middle turbinate and below the sphenopalatine ganglion is well anesthetized by topical applications.

With good light, the nasopharynx can now be seen through each choana, and the adenoid mass can be seen hanging below its vault. (Incidentally, in children this visibility of the adenoid after nasal shrinkage is often a great aid, especially in examining for recurrent adenoid, when the gag reflex makes posterior rhinoscopy impossible.) With a 22 gage, 4 inch (10.16 cm), straight Luer's needle and a 2 cc Luer's syringe, 1 or 2 cc of 1 per cent procaine hydrochloride can now be injected beneath the adenoid on each side, inserting the needle just behind the upper rim of the choana (see accompanying illustration), and advancing the point about 1.5 cm as the solution is slowly injected. In five minutes adenoidectomy

* Submitted for publication, Nov 28, 1930

1 Nelson, Roy F. Adenoids in Adults, Arch Otolaryng 10:70 (July) 1929

can be performed and digital exploration done as thoroughly and as painlessly as under general anesthesia. A postnasal pack or string sponge may be applied for ten minutes if desired.



Drawing of the field of operation, showing the places (marked by x) for the local injection of anesthesia.

This technic is not feasible with a low deviation of the septum, unless resection of the submucous membrane is first performed, but adenoidectomy can easily accompany the latter operation. Adenoid masses confined to the fossae of Rosenmüller also are often not accessible.

411 Thirtieth Street

METHOD OF OUTLINING MUCOCELE BY THE INJECTION OF IODIZED OIL

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Until a few years ago mucocoele of the paranasal sinuses was considered an uncommon occurrence, but owing to increasing knowledge and improved methods of diagnosis the condition is becoming more recognized. Cases are reported more frequently in the recent literature than in previous years.

Formerly symptoms of swelling in the orbital region were often diagnosed as cysts of the bone which on closer examination at a later date proved to be mucocoele. Howarth,¹ in the Hunterian lecture before the Royal College of Surgeons of England, gave credit to Logan Turner of Edinburgh and Gerber of Germany for "elucidating the condition and placing it upon a scientific basis."

Mucocoele is an accumulation and retention of a mucous secretion within a sinus associated with obstruction of its outlet. According to Turner,² a previous chronic nasal catarrh is usually the reason for the inflammatory changes that take place, causing obstruction of the ostium of the sinus. The mucus then continues to secrete and accumulate, resulting in a thinning and absorption of one or more of the bony walls. Direct trauma and occlusion of the ostium due to an osteoma are also given as causes. The etiology varies, however the essential feature is that the condition is due to more or less complete blockage of the ostium.

Theoretically, any of the sinuses may be affected, but in the majority of cases the frontal or anterior ethmoidal cells are involved. Cases have been reported in which the mucocoeles arise from the maxillary antrum, but it is now thought that most of these were cysts of dental origin which gradually obliterated the antrum.

Mucocoele of the sphenoidal sinus is such a rarity that many observers doubt its existence.

^{*} Submitted for publication, Jan 21, 1931

Read before the Montreal Medico-Chirurgical Society, Nov 21, 1930

1 Howarth, W G. Mucocoele and Pilocoele of the Nasal Accessory Sinuses, *Lancet* 2 744, 1921

2 Turner, A. Logan. Mucocoele of the Accessory Nasal Sinuses, *Edinburgh M J* 22 396 and 481, 1907

CLINICAL FEATURES AND SYMPTOMS

The patient usually notices a painless swelling which appears at the inner and upper angles of the orbit. The sensation elicited varies from bony hardness to a parchment-like feeling or fluctuation, depending on the amount of absorption of bone. A true mucocele is not tender on gentle palpation and there is an absence of pain or redness unless it becomes infected (pyocele).

The skin overlying the swelling remains unchanged and is freely movable. Pressure does not reduce its size. The slow progress of the swelling is characteristic until the bone becomes eroded when it usually develops rapidly. Symptoms of pressure on the orbital contents appear and when present the eyeball is displaced downward and outward. Diplopia is sometimes present but it is not a constant feature and it is occasionally surprising to see a great degree of displacement of the globe without double vision. When it does occur the images are seen one above the other. The ophthalmologic examination usually gives negative results, movements of the eyeball are not as a rule, affected, the pupil reacts to light, and the fundus is normal. When pressure from the swelling involves the nasolacrimal duct epiphora is an early symptom and this together with the orbital displacement frequently causes the patient to consult an ophthalmologist. A lack of definite symptoms is characteristic of this condition. Headache is perhaps the chief complaint although as a rule it is not localized. More often the patient complains of a generalized ache. Exophthalmos is occasionally present, depending on the situation of the swelling and the amount of pressure on the orbital contents.

These cases are not sufficiently rare to report unless there is something unusual in their character. The fact that iodized poppyseed oil 40 per cent was used to outline the extent of the mucocele and the result obtained prompted the reporting of the following case. In the literature no mention was found of the use of iodized oil, although several hundred cases have been reported. However, as the use of opaque oil has come more into prominence in rhinology during the past few years this is not surprising.

REPORT OF CASE

A man, aged 29, complained of an occasional right frontal headache, a slight swelling below the right eyebrow of three months' duration and that the right eye was "not quite straight."

There were no other symptoms, that is, there was no impairment of sight or double vision, no previous nasal discharge and no history of trauma.

Examination showed a moderately firm, circumscribed swelling, about the size of a small grape, at the inner and upper angle of the right orbit. There was no redness, the skin over the swelling being freely movable and unaltered. All movements of the globe appeared normal, although the right inner canthus was

0.3 cm lower than the left. Gentle palpation of the swelling did not alter its size or cause pain, although there was slight tenderness on firm pressure.

Intranasal examination showed nothing abnormal. On transillumination, the right frontal sinus appeared darker than the left. Vision in both eyes was perfect, and the fundi were normal.

The patient was advised to have the usual external operation, the alternative intranasal method of breaking down the anterior ethmoid cells and establishing free drainage was also explained. The latter procedure strongly appealed to the patient, as he was anxious to return to work as soon as possible. The anterior end of the right middle turbinate was removed under local anesthesia. On removal

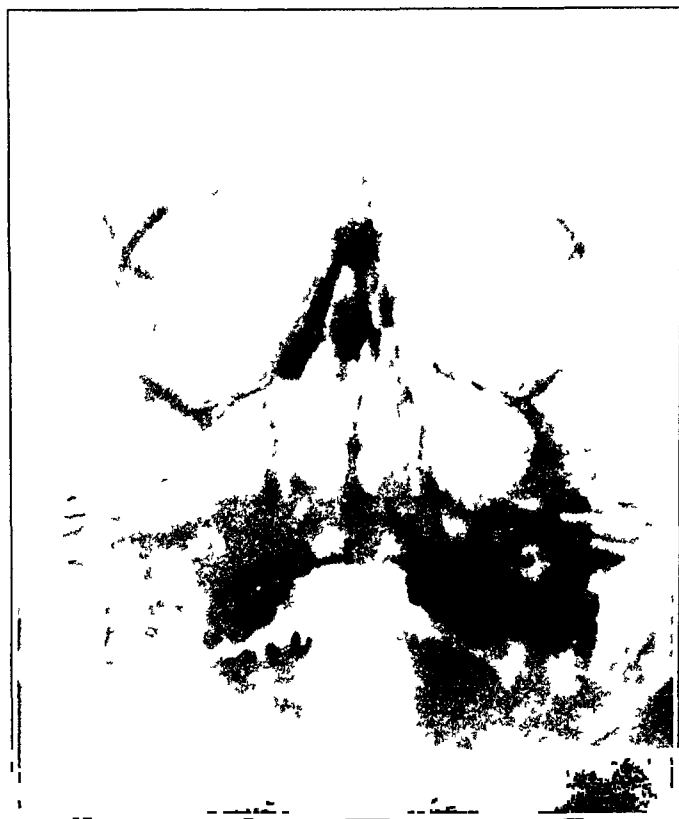


Fig. 1—Anteroposterior view, showing the mucocoele encroaching on the right orbit.

of the bone, a few drops of glairy, chocolate-colored fluid appeared near the attachment of the middle turbinate with the lateral wall. On gentle manipulation, by means of a cotton-tipped applicator, the opening was found and the depth of the mucocoele measured. The probe extended inward 9 cm from the nasal spine, practically straight backward and upward at an angle of 45 degrees. A flexible cannula attached to a suction machine was introduced and the fluid in the mucocoele aspirated. This was done in order to obtain a little of the contents for bacteriologic examination, as most of the cases reported showed sterile fluid on culture. The result proved to be the same in this case. Aspiration of the cavity suggested the possibility of injecting iodized oil through the cannula in order to



Fig 2—Lateral roentgenographic view The mucocoele can be seen extending backward into sphenoidal sinus

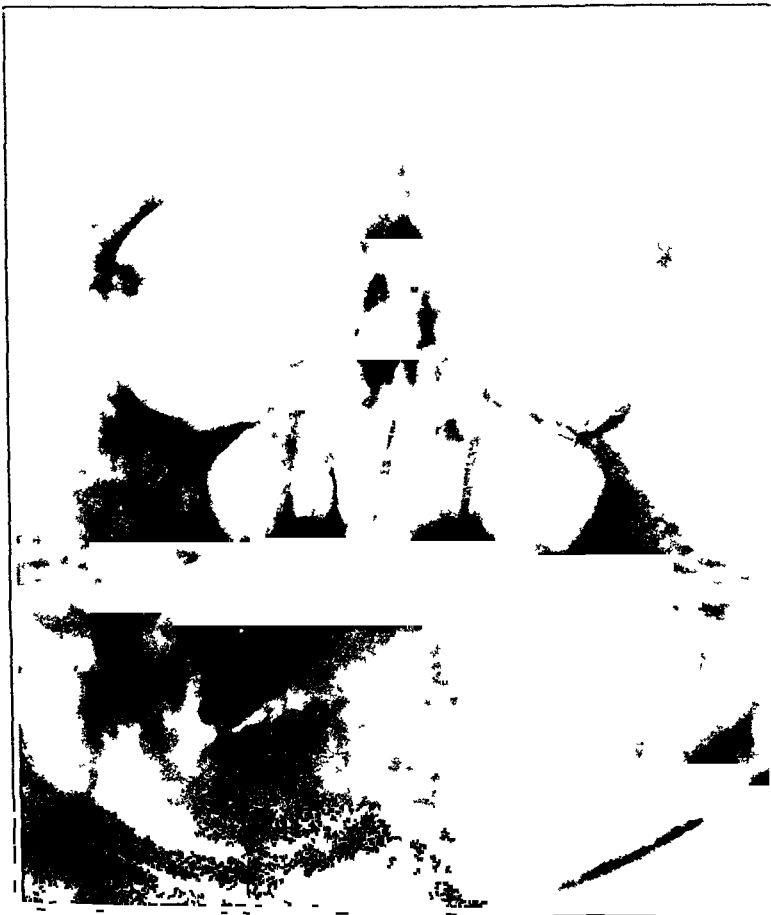


Fig 3—Roentgenogram taken after the injection of iodized oil

outline the whole extent of the mucocoele. This was accomplished with the patient lying on the table, the chin being raised to an angle of about 15 degrees. As the caliber of the cannula was considerably less than the opening into the mucocoele, there was sufficient space for the escape of air. After inserting the cannula, the oil was injected slowly, exactly in the same manner as is used in outlining the frontal sinus. On the appearance of the overflow in the nose, the cannula was removed and a small moistened pack of absorbent cotton placed in the opening to prevent the oil from leaking out. Roentgenograms both anteroposterior and

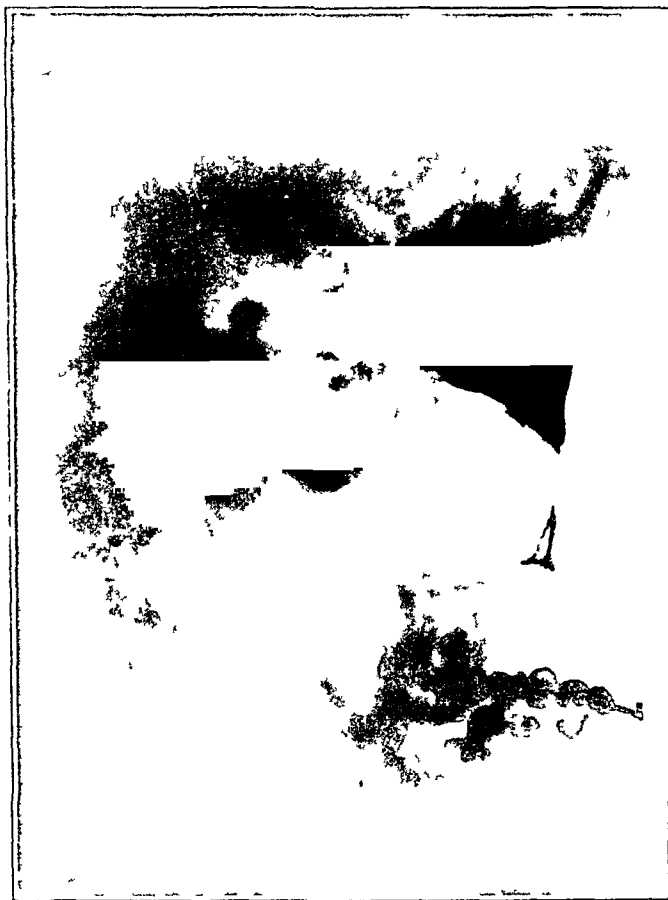


Fig 4—Side view, showing the mucocoele filled with iodized oil and the location of the ostium

lateral views, were taken immediately, with the results shown in the accompanying figures.

Although the anteroposterior plate shows that the mucocoele extended well above the roof of the orbit, no connection could be found with the frontal sinus. The lateral view, especially figure 4, shows that the mucocoele was ethmoidal, the majority of recorded cases appear to be of this type (usually the anterior group). Superiorly the wall of the cavity blended with the floor of the anterior and middle fossa, while posteriorly it extended through the sphenoidal sinus and approached the pituitary fossa.

COMMENT

Although the injection of iodized oil proved successful in this case, one would hesitate to use it without previous x-ray plates, in order to be certain that the mucocele had not eroded into the anterior or the middle fossa.

In conclusion, it might be mentioned that in this case only the simple intranasal opening was made. The chance of recurrence was explained to the patient, but he promised to return and to undergo the external operation if there was any further need.

Under local anesthesia, the ostium of the mucocele in the middle meatus was enlarged and the anterior ethmoid cells curetted away. A large drainage tube was inserted and held in place for ten days. Nothing further was done. The patient was kept under observation to note the size of the swelling in the orbit from time to time.

Within a month, the eye had returned to its normal position, and the swelling had disappeared.

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ANAPHYLACTIC CHANGES IN THE NASAL MUCOSA OF GUINEA-PIGS

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My purpose in this paper is to record experiments on animals undertaken to determine what constant changes, if any, occur in the nasal mucous membrane in anaphylactic shock. The work was carried out at the Otolaryngological Laboratory of the Massachusetts Eye and Ear Infirmary.

It is well known that animals can be sensitized to foreign proteins. Guinea-pigs were selected for these experiments because of the ease with which they may be rendered sensitive. Ten animals in all were used, and eight were sensitized to two different allergens, two animals being reserved for controls. Five were given intraperitoneal injections of 0.2 cc. of horse serum, and the other three a very dilute solution of filtered egg albumin, the nitrogen content of which was not determined. After the injections were given, an interval of two weeks in the case of those given horse serum and of three weeks in those given egg albumin was allowed to elapse so that complete sensitization might take place. At the end of this period, the animals were again given intraperitoneal injections of 5 cc. of the respective sensibilisinogens employed to produce the allergic condition. An anaphylactic reaction was elicited in six of the eight animals, and no apparent changes were manifested in the other two. The severity of the anaphylactic phenomenon was well demonstrated by changes which were produced with egg albumin. Starting within a few minutes after the injection, gross symptoms occurred rapidly, reaching a climax within twenty minutes. One of the animals failed to react. The animals given horse serum reacted in a lesser degree, and death did not take place for several hours. After a moderately severe paroxysm lasting for two hours one guinea-pig recovered, but was killed twenty-four hours later with potassium cyanide. Another failed to show any response.

SYMPTOMATOLOGY

The gross symptoms were characteristic in all cases, the severity was commensurate with the violence of the reaction. First there was a preliminary or incubation period lasting from one to several minutes. This

¹ Submitted for publication, Jan. 5, 1931.

² From the Otolaryngological Laboratory of the Massachusetts Eye and Ear Infirmary.

was followed by itching of the nose and at the site of the injection, as shown by the violent scratching of these areas. The respiration became accelerated, the fur appeared ruffled and stood on end, and urine and feces were discharged. Marked weakness set in, the hind legs were affected first. The breathing became labored, irregular, shallow and slow. The animal fell to one side, and the muscles of the legs and trunk twitched irregularly. Deep cyanosis developed. This was most noticeable on the extremities and about the nose and mouth. Convulsions set in, and the animal often attempted to rise and run, heedless of any sense of direction. Death usually followed after one or

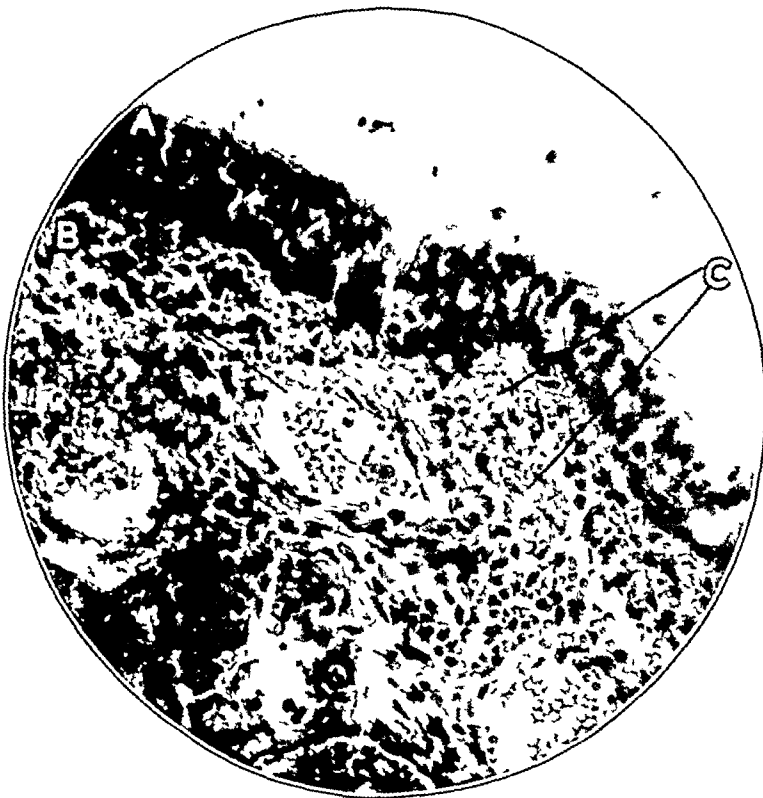


Fig 1—The nasal mucous membrane of a guinea-pig that died from anaphylactic shock three hours after the injection of horse serum. *A* indicates surface epithelium, *B*, blood vessels, and *C*, petechial hemorrhage in the propria just York, The Macmillan Company, 1914, chapters on anaphylaxis

two of these paroxysms. At autopsy the well known observation, namely, distended, pale bloodless lungs which filled the thorax, was present. Sections of the lungs showed heaping up of the mucous membrane and numerous small hemorrhages around the bronchioles.

MICROSCOPIC OBSERVATIONS

The mucous membrane from the nose and the adjacent structures was removed, fixed and stained by the ordinary procedures for examination. The normal mucous membrane of the guinea-pig resembles that of man. The epithelium is ciliated and pseudostriated and lies on a

thin band of basement membrane. There is a well developed tunica propria which consists of fibrillar and fine elastic tissue. This is especially abundant in the deeper layers and contains many mixed, branched, tubulo-alveolar glands and a few lymphocytes that occasionally form a solitary node. The tunica propria is well supplied with blood vessels and forms a dense network or plexus subepithelially.

On microscopic examination certain changes were marked. In the animals in which the symptoms of anaphylaxis lasted several hours, the changes were well defined. The following microscopic observations were made. Certain areas of the epithelial tissue showed distended

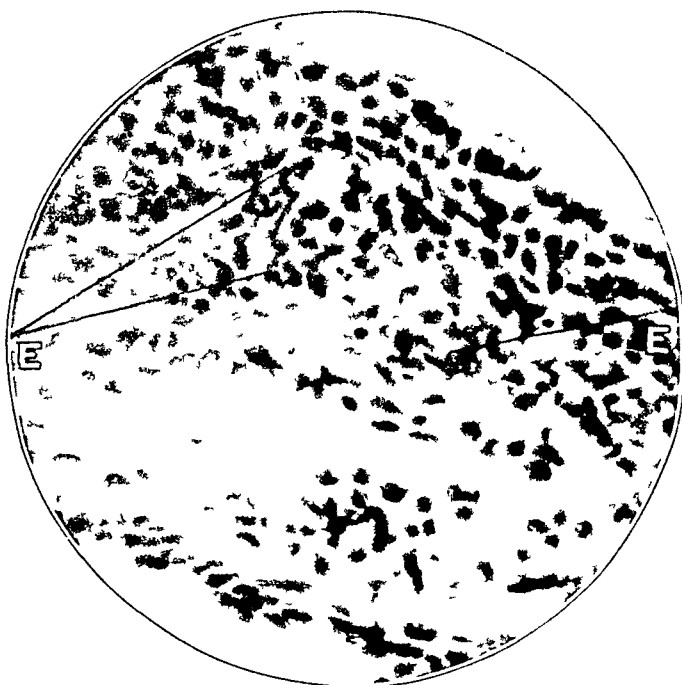


Fig 2—The nasal mucous membrane of a guinea-pig killed with potassium cyanide twenty-four hours after recovery from anaphylactic shock produced by the injection of horse serum. *E* indicates dense eosinophilic infiltration in the subepithelial tissue.

goblet cells, while other goblet cells were discharging their contents. More striking changes were found beneath the membrana propria in the subepithelial tissue. Sections from the guinea-pig that was killed with cyanide showed a dense infiltration of eosinophils. Scattered infiltrations of eosinophils were found in the other sections. All of the blood vessels beneath the membrana propria were dilated and filled with blood. There was a generalized hyperemia in the plexus of blood vessels. The chief and most important observation beneath the basement membrane, however, was the presence of numerous petechial hemorrhages.

COMMENT

The animals that were sensitized with a powerful allergen reacted more quickly and to a severer degree than those in which weaker allergens were used hence the anaphylactic process developed to a maximum point with death ensuing in a few minutes In these cases due to the rapid transition from the initial to the final stage there was relatively little chance for many changes to take place therefore the pathologic changes were in direct proportion to the reaction elicited The gross symptoms may be attributed to the influence of the stimulation of smooth muscle It has been shown by a number of workers experimenting on various animals that such stimulation is a prime factor in the phenomenon of anaphylaxis It is believed that the action is on the muscle cells themselves rather than on the nerve endings The work of Biedl and Kraus¹ tends to confirm this view

The etiology of the petechial hemorrhages is somewhat obscure Several factors may be involved Certain endothelial changes plus spasm of the walls of the arterioles could account for this pathologic change In their studies Gay and Southard² referred to local fatty changes in the capillary endothelium that may play a part No plausible explanation is offered for the animals that failed to react other than that they failed to become sensitized

CONCLUSIONS

Anaphylaxis in the guinea-pig is manifested by definite and characteristic symptoms They may be severe and of short duration or mild and drawn out Death does not necessarily follow an attack The microscopic observations in the nasal mucous membrane are pronounced They are as follows eosinophilia congestion and especially petechial hemorrhages

Dr T B Mallory gave me suggestions for this paper and reviewed the slides

1 Biedl and Kraus in Zinsser, Hans Infection and Resistance, ed 3 New York, The Macmillan Company 1914, chapters on Anaphylaxis

2 Gay and Southard On the Method of Serum Anaphylaxis and Intoxication in the Guinea Pig, J M Research **13**:410, 1908 On Serum Anaphylaxis in the Guinea Pig *ibid* **11** 161 1907

RETROBULBAR OPTIC NEURITIS ORIGINATING IN THE NASAL SINUSES

A NEW METHOD OF DEMONSTRATING THE RELATION BETWEEN THE SPHENOID SINUS AND THE OPTIC NERVE^{*}

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In spite of the fact that ophthalmology and rhinology seem to have become two separate and distinct specialties, they have so many interesting and difficult problems in common that there will always be a need for close and intelligent cooperation between those practicing these two branches of medicine.

This need is real in the problem of retrobulbar optic neuritis originating in the nasal sinuses. This condition has been studied and speculated on for hundreds of years. According to Canuyt, Ramadier and Velter,¹ Baratoux² stated that in the eleventh century, Ali-Ibu-Isa, a Persian, described the engorgement, compression and inflammatory swelling of the optic nerve resulting from a nasal "catarrh", in the eighteenth century and first two thirds of the nineteenth, there appeared from time to time, reports of cases which showed that there was an understanding of the relation between certain ocular symptoms and disease of the nose and sinuses. In all these observations, however, the concomitance of ocular disturbances and suppuration of the sphenoid and ethmoid sinuses was found only at autopsy. By 1877, clinicians began to look for a relation between certain obscure visual troubles and disease of the posterior sinuses, and in 1886, Berger demonstrated perineuritis of the intracanalicular portion of the optic nerve of sphenoid-ethmoid origin.

Canuyt, Ramadier and Velter quoted Ziem as writing in 1892, "In ten years, one will not be able to practice ophthalmology without rhinology," and "two thirds of the ocular affections have their origin in an unrecognized rhinopathy." They mentioned the work of Grunwald in 1893, the article of Parinaud on retrobulbar neuritis in 1896, and the impetus given to the subject by Delapersonne who stated, in

^{*} Submitted for publication, Oct. 10, 1930.

^{*} Read at a meeting of the Chicago Laryngological and Otological Society, Dec. 1, 1930.

¹ Canuyt, Ramadier and Velter. Les sinusitis posterieures et leurs complications oculaires, *Ann. d. mal. de l'oreille, du larynx* **44** 39 (Jan.) and 140 (Feb.) 1925.

² Baratoux. *Monographies medicales*, Dec. 15, 1923.

1898, that one should suspect and examine the sphenoid sinus in cases of ocular symptoms of undetermined origin, and who reported three cases of optic neuritis resulting from sphenoiditis without any of the usual signs of sinusitis

Since then, the literature of retrobulbar optic neuritis has become quite extensive, the names of Sluder, Leon White, Loeb and Jonathan Wright standing out among the American writers

To White³ great credit must be given. He consistently worked on the subject, and published many important contributions the first of which appeared in 1916

However, the mechanism of the production of retrobulbar optic neuritis of nasal origin has not been proved clinically or experimentally, and therefore has become a much discussed question. The theories which have been advanced are (1) a toxic action on the papillo-macular bundle, (2) direct extension of the infecting agents from the posterior sinuses to the optic nerve through dehiscences or along blood and lymphatic vessels, (3) hyperplastic bony changes with resulting pressure on the optic nerve in the optic canal

None of these seems to explain satisfactorily the clinical picture. One important factor has been the absence of suitable material for autopsy. Practically all the microscopic studies were done on tissue removed at the time of operation, mostly bits of the anterior wall of the sphenoid sinus

In 1928, Prof. H. Herzog,⁴ of Innsbruck, Austria, demonstrated, I believe, the real mechanism of the production of retrobulbar optic neuritis originating in the nasal sinuses. He examined 435 chronic and 65 acute cases of disease of the nasal sinuses between the years 1919 and 1927. Thirteen cases, or 2.6 per cent, presented definite characteristics of retrobulbar neuritis. Of these 13 cases, 6 occurred in chronic inflammation of the sinuses, and 7 in acute inflammation. In other words, according to Herzog, changes of the optic nerves were present in acute sinusitis from 7 to 8 times more frequently than they were in chronic sinusitis

Herzog did not have any cases of retrobulbar optic neuritis that came to autopsy, but in sections of other cases he found that when there were extensive marrow spaces of the bone between the optic canal and the sphenoid sinus, these were intimately connected with the submucosa of the sinus and the dura of the sheath of the optic

³ White, Leon. Loss of Sight from Retrobulbar Neuritis, Due to Accessory Sinus Disease, with a Report of Two Cases, Boston M. & S. J. **174** 790 (June 1) 1916

⁴ Herzog, H. Ueber die Neuritis retrobulbaris, Arch. f. Augenh. **99** 291 (July) 1928

nerve by means of cellular processes running from the dura into the spaces where they blended with cellular elements derived from the submucosa of the sphenoid sinus extending into the same spaces. He found that there were many more openings into the marrow spaces from the side of the nasal sinus than from that of the optic nerve. He demonstrated a normal variation in the amount and size of the marrow spaces in the bony wall between the optic nerve and sphenoid sinus.

He showed that infection in the sphenoid sinus had extended readily into the marrow spaces from which it could easily pass along the cellular processes into the sheath of the optic nerve. He found edema with other inflammatory changes in the marrow spaces without



Fig. 1—The Vail-Lange position for roentgenogram of the right sphenoid sinus.

any changes in the sinus mucosa. He stated that slight inflammatory changes in the superficial layer of the sinus mucosa could disappear while a severe infection continued in the marrow spaces. This was considered the explanation of the practically negative indications in the sinus.

These conditions were well illustrated by Herzog. He felt that the pathologic process in retrobulbar neuritis was one of circumscribed serous meningitis of the sheath of the optic nerve, with or without interstitial changes in the nerve.

His work was verified in one case reported by ten Doesschate.⁵ The latter reported a case of chronic pansinusitis with death from

⁵ ten Doesschate, G. *Klin Monatsbl f Augenh* 80:831 (June) 1928.

pneumonia. Microscopic study showed purulent infiltration with diplococci in the mucosa of the sphenoid sinus, in the bone marrow of the wall between the sphenoid sinus and the optic nerve, in the dual sheath of the optic nerve and in its septums.

However, there are some who feel that retrobulbar optic neuritis originating in the nasal sinus is a rare condition, they believe that the cases are not surgical, that retrobulbar optic neuritis is usually the first symptom of multiple sclerosis, that for this reason, operations on the sinuses are not indicated, and that any restoration of vision following such surgical procedures are coincidental and merely due to the fact that there are natural periods of remission in the course of multiple sclerosis.

Scheerer⁶ felt that only 15 per cent of the 203 cases of retrobulbar optic neuritis seen by him from 1921 to 1928 were due to disease of the nasal sinuses. He claimed that multiple sclerosis is the chief cause of retrobulbar optic neuritis. In all but one of Scheerer's acute cases the patient recovered vision without nasal operation, he felt that the prognosis for the return of vision under local and medical treatment in the acute cases was good.

Marx⁷ stated that the diagnosis of retrobulbar optic neuritis originating in the nasal sinuses is often difficult to make. Often it is made, as Bruckner said, from "Wahrscheinlichkeit (probability)." To prove that the cause is in the posterior sinuses is difficult, but as a rule it is possible after careful examination. In some cases an exploratory diagnostic operation is indicated. In the differential diagnosis, multiple sclerosis is of first consideration. The space of time from the onset of the retrobulbar optic neuritis until the appearance of symptoms of multiple sclerosis may be ten years or longer.

In a group of cases in which a nasal operation was performed, improvement in vision resulted, but later multiple sclerosis appeared. However, no statistics on this subject were given by Marx.

Marx stated that Meller and Wertheim believed that in cases in which the rhinologic observations are negative and in which no other certain etiologic factor can be found, one should operate. Hajek, von Eiken and Schlesinger had the opposite view, while de Kleyn, Jung and Elschmig reported good results from conservative therapy. No radical operation is necessary in any of the cases, according to Marx.

Marx quoted Kostenbaum's series of thirty-five cases of retrobulbar optic neuritis originating in the nasal sinuses. Eight patients were

⁶ Scheerer, R. Ueber die Ursachen der Neuritis retrobulbaris, *Klin Monatsbl f Augenh* **83** 164 (Aug-Sept) 1929.

⁷ Marx, Hermann. Die orbitalen Komplikationen bei Nebenhöhlenentzündungen, *Handb d Hals-, Nasen- Ohrenh* **2** 977, 1926.

operated on and twenty-seven were not. Of the latter, eighteen recovered and two were considerably improved. Seven showed no change. Eight of the thirteen eyes operated on showed no improvement, the others had the same relative course as the eyes not operated on.

Weill⁸ stated that from his researches the rhinologist practically never observes acute retrobulbar neuritis associated with posterior sinusitis and that the ophthalmologist practically never sees lesions of the sinuses in cases of retrobulbar optic neuritis. Of forty cases, he observed a progressive return of vision without surgical intervention in more than 85 per cent.

He stated: 1. The prognosis of acute retrobulbar optic neuritis even without surgical intervention may be considered favorable. 2. The origin of acute retrobulbar optic neuritis should be sought some-



Fig 2 (case 1, Mrs. B., diagnosis, retrobulbar optic neuritis on the left side, recurrent attacks)—*A*, anteroposterior roentgenogram with the head in the vertical position. Radiopaque oil has been injected into the left maxillary and sphenoid sinuses. The filling defect of the maxillary sinus and the very large size of the sphenoid sinus are well shown. *B*, lateral view, showing the filling of the left maxillary sinus and sphenoid sinus with radiopaque oil.

where else than in the posterior sinuses. 3. Acute retrobulbar neuritis is to be considered as the first, and often the only, sign of multiple sclerosis. 4. The condition does not call for an operation on the sinuses.

Obviously, he must have overlooked the clinical and pathologic studies of Herzog and the mass of evidence accumulated from American authorities.

8 Weill, G. A. The Relationship Between Inflammation of the Posterior Sinuses and Disease of the Nervus Opticus, *Arch. Ophth.* 1: 307 (March) 1929.

According to Ziegler,⁹ who studied 529 cases of multiple sclerosis at the Mayo Clinic from 1915 to 1927, defects of vision such as diplopia and central scotoma constituted the symptoms at onset in only 14.4 per cent. He recorded an insidious onset in 456 cases, or 86.2 per cent, and stated that the onset and recurrences are more frequent in the spring and early summer months, that long remissions may occur, but that complete remission of all symptoms is rare. Death occurred in 136 (25.7 per cent) of the 529 cases. The average length of life from the onset of the disease until death was over seven years, in the cases on which data could be obtained.

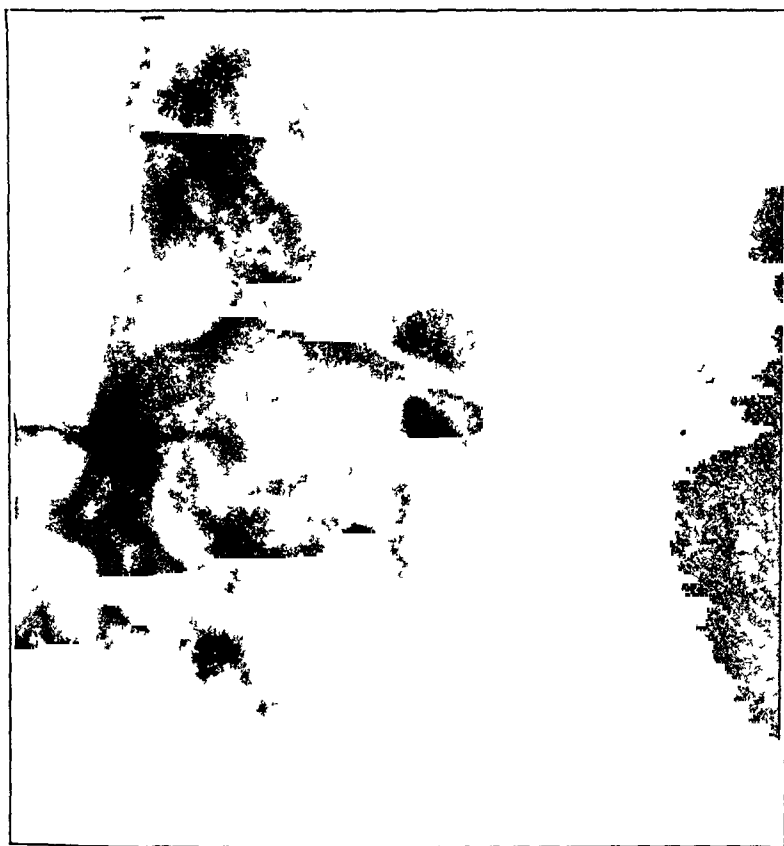


Fig. 3 (case 1) —Roentgenogram showing the relation of the sphenoid sinus to the optic canal by the Vail-Lange position. From a careful study of this film it would seem that there is a slight filling defect of the upper outer angle of the sphenoid sinus.

Ziegler's observations would seem to refute the belief that retrobulbar optic neuritis is the first and only sign of multiple sclerosis.

Is it not possible for infecting agents to gain access to the central nervous system from a site in the posterior nasal sinuses, with visual disturbance as the first and most natural symptom? If bacteria spreading from a sinus focus can involve the optic nerve, cannot the virus

⁹ Ziegler, L. H. Multiple Sclerosis. A Clinical Review and Follow Up Study, *Minnesota Med* **12** 778 (Dec.) 1929.

of multiple sclerosis act in the same way? Shall one deprive patients of a possible chance of avoiding or postponing the onset of multiple sclerosis by neglecting to drain surgically those nasal sinuses which are nearest the optic nerve? That multiple sclerosis may develop later is no argument against operations on the posterior nasal sinuses, and certainly the argument advanced by a few writers, that surgical intervention has been responsible for blindness and even death, and therefore should not be employed, is no argument. It should take a long

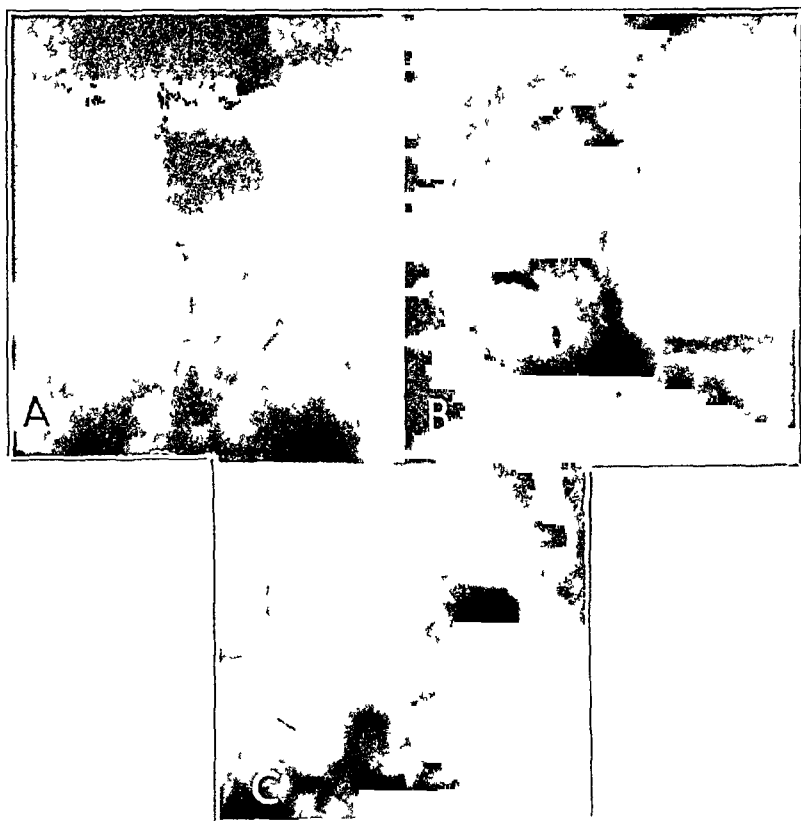


Fig 4 (case 3, Miss D, diagnosis, bilateral retrobulbar optic neuritis and multiple sclerosis)—*A*, radiopaque oil has been injected into the right sphenoid sinus and the films made with the head in the vertical position. Note the large size of the sphenoid sinus. *B*, a lateral view showing the large size of the right sphenoid sinus. *C*, the right sphenoid sinus has been filled with radiopaque oil and the roentgenogram made in the Vail-Lange position. Note the absence of any filling defect and the intimate relation of the radiopaque oil to the optic canal.

time for the virus of multiple sclerosis to spread throughout the central nervous system and for the other symptoms of the disease to develop. The papillomacular bundle is a very delicate nervous tissue. The various other nervous tissues affected in multiple sclerosis are more resistant.

Remissions in the course of the disease can be explained by remissions in the infection of the nasal sinuses. Similar remissions are encountered in retrobulbar optic neuritis of obvious nasal sinus etiology.

One encounters somewhat analogous conditions of the central nervous system in epidemic encephalitis (lethargica), serous meningitis, chronic arachnoiditis and various psychoses, all of which can be caused by an inflammation in the nasal accessory sinuses.

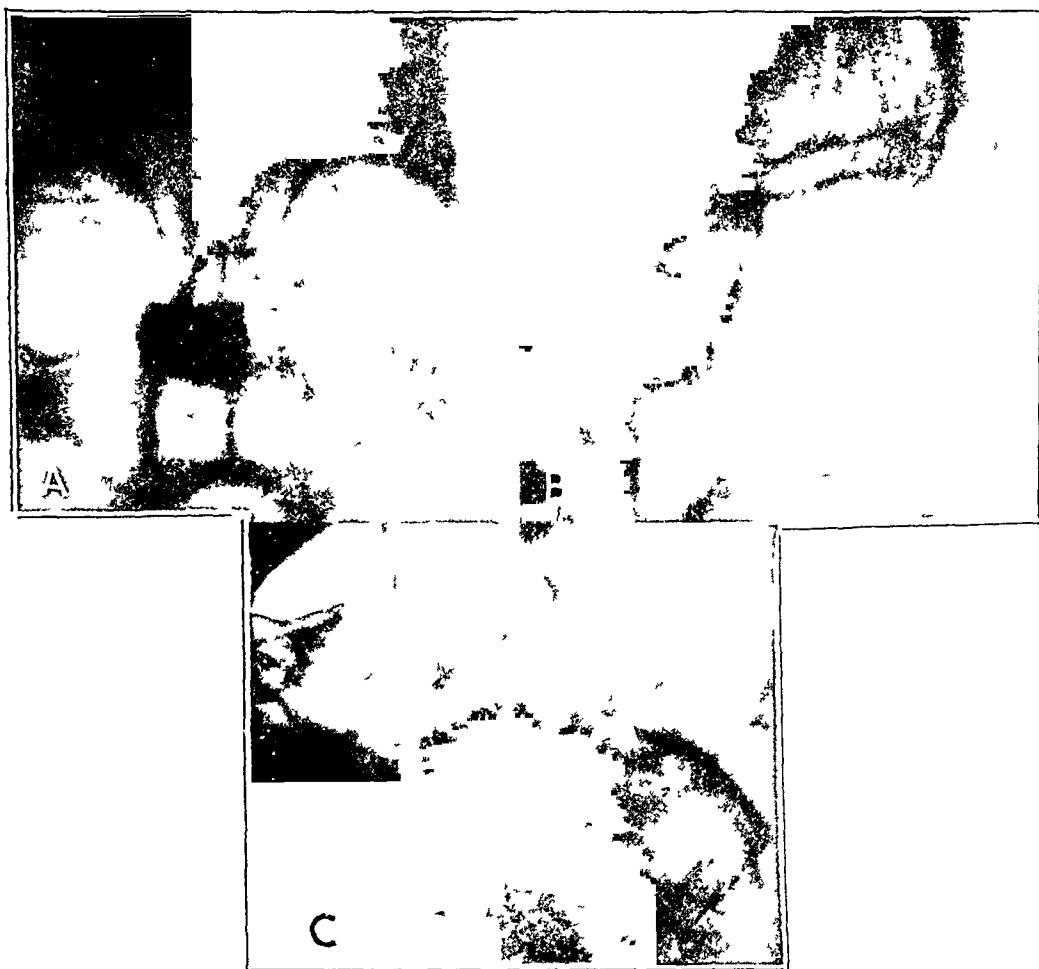


Fig 5 (case 4, Mr V, diagnosis, bilateral retrobulbar optic neuritis and multiple sclerosis) —A, radiopaque oil has been injected into the left sphenoid sinus, note the large size of the sinus. B, a lateral view showing the large size of the sphenoid sinus. C the Vail-Lange position. Note the absence of a filling defect and the intimate relation of the radiopaque oil to the optic canal.

In the years 1920 and 1921, I was fortunate, as an intern in the Massachusetts Eye and Ear Infirmary, in being able to work under Dr. Leon White. I saw a great many of his cases, was present at his operations and performed some under his guidance. I could not help but be inspired by the high quality of his work.

When I returned to Cincinnati in 1921, I had a further opportunity in being associated with my father, Dr. Derrick T. Vail. From his large ophthalmologic practice, I obtained the material concerning which I report.

In the years 1921 to 1929, inclusive, twenty-three cases diagnosed by Drs. D. T. Vail, Sr., and Jr., as retrobulbar optic neuritis were referred to me. Of these twenty-three, eight were found after careful

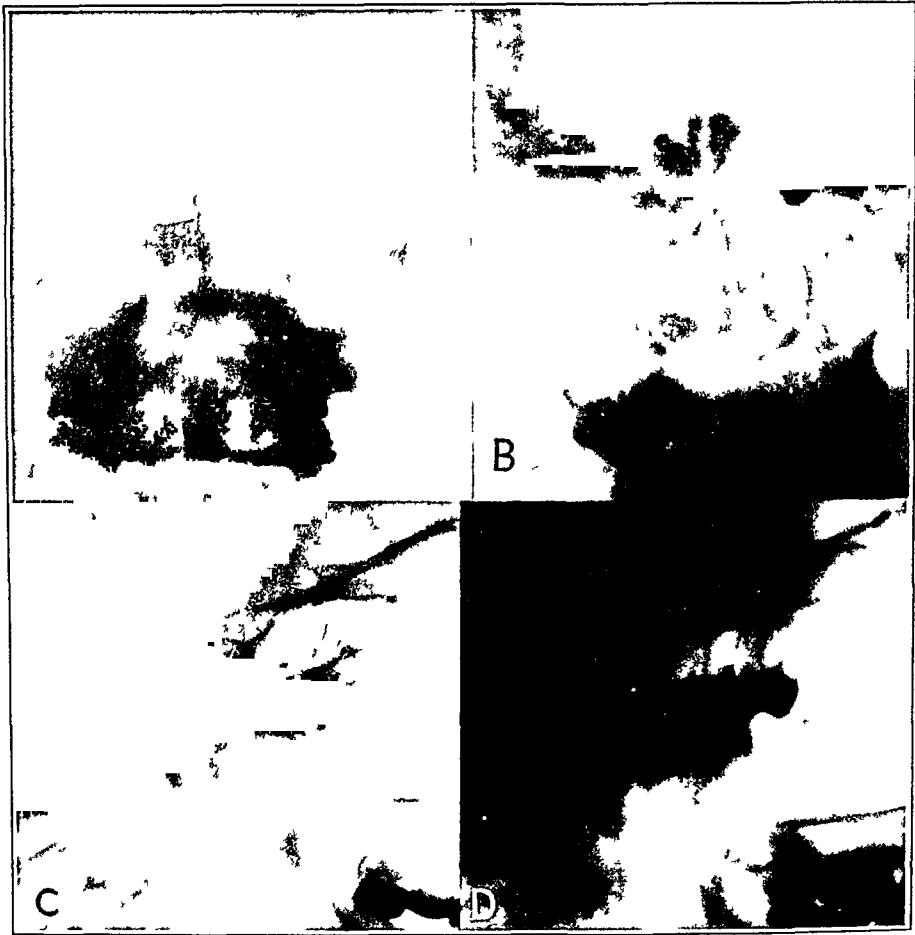


Fig. 6 (case 5, Mrs. S., diagnosis, central choroiditis and chronic tonsillitis, disease of the sinuses not demonstrable clinically) —*A*, roentgenogram of the left sphenoid sinus after the injection of bromipin 33 per cent, the head is in the vertical position. Note the large size of the sphenoid sinus. *B*, anteroposterior roentgenogram made after the injection of iodized poppy seed oil 40 per cent in the right sphenoid sinus, with the head in the vertical position. The shadow of the bromipin in the left sphenoid sinus is dim. The right sphenoid sinus received an injection of iodized oil three hours after the bromipin was injected into the left sinus. Note the asymmetry of the two sphenoid sinuses. *C*, lateral roentgenogram with the head in the vertical position, bromipin was injected into the left sphenoid sinus. The large size of the sinus can be seen. *D*, a roentgenogram of the right sphenoid sinus following the injection of iodized oil with the head in the vertical position. What might be taken for a filling defect is probably due to an overlapping of the left sphenoid sinus.

physical, neurologic and serologic examination by competent examiners to be due to syphilis, tobacco, lead, quinine, multiple sclerosis and pernicious anemia. The remaining fifteen were diagnosed by me as of nasal sinus etiology. A careful rhinologic and roentgen examination

TABLE 1—*The Etiology of Retrobulbar Optic Neuritis in Twenty-Three Cases (1921-1929)*

	Origin in Nasal Sinus	Syphilis	Tobacco	Lead	Quinine	Pernicious Anemia and Multiple Sclerosis	Multiple Sclerosis
Cases	15	2	2	1	1	1	1
Per cent	65.2	8.7	8.7	4.3	4.3	4.3	4.3

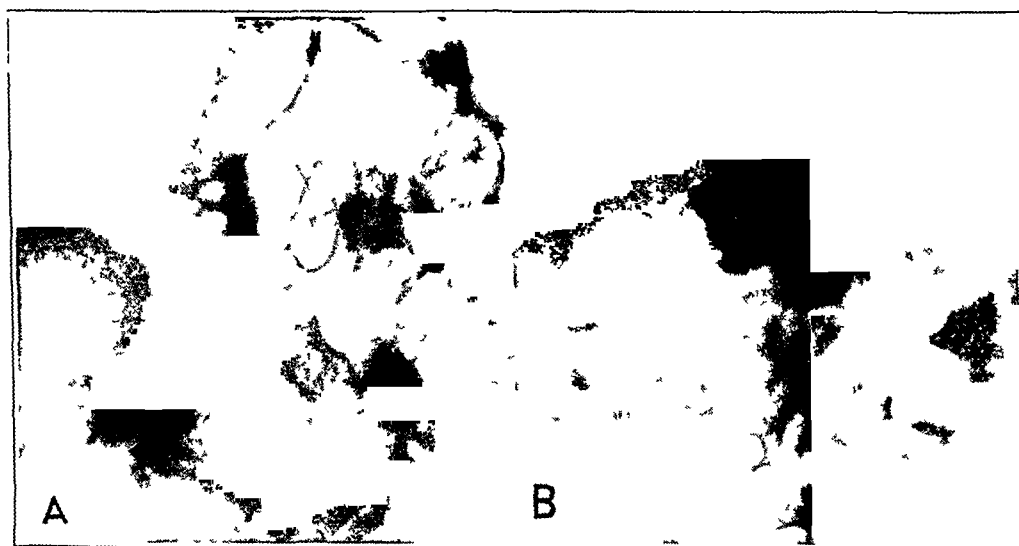


Fig 7 (case 5)—*A*, roentgenogram of the left sphenoid sinus showing the close relation between the sphenoid sinus and the optic canal. From this film it can be definitely ascertained that the cell lying near the optic canal is not a part of the left sphenoid sinus. *B*, roentgenogram of the right sphenoid sinus in the Vail-Lange position, following the injection of iodized oil. The close relation between the sphenoid sinus and the optic canal is shown. The paranasal sinus cell near the optic canal is definitely proved not to be of either sphenoid sinus and is therefore probably a portion of the posterior ethmoid system.

was made in all cases. Negative roentgen observations were made in ten cases (66 per cent). Clouding of the ethmoids, demonstrated roentgenologically, and positive clinical indications in the nose were present in five cases (33 per cent).

According to the records of Drs D. T. Vail, Sr, and Jr, a normal fundus was present in eight cases, optic neuritis was found in five cases and sectional optic atrophy in two of the cases of longer duration. There was a central scotoma for white and colors in the more severe

cases, in two mild cases it was for colors only. The peripheral field was normal in all cases. Visual disturbances ranged from mild central scotoma to a severe diminution of vision, but in no case amounted to total blindness.

The youngest patient was a boy aged 12 years, the oldest, a man aged 58. In three cases the retrobulbar optic neuritis was bilateral. Seven male and eight female patients were affected.

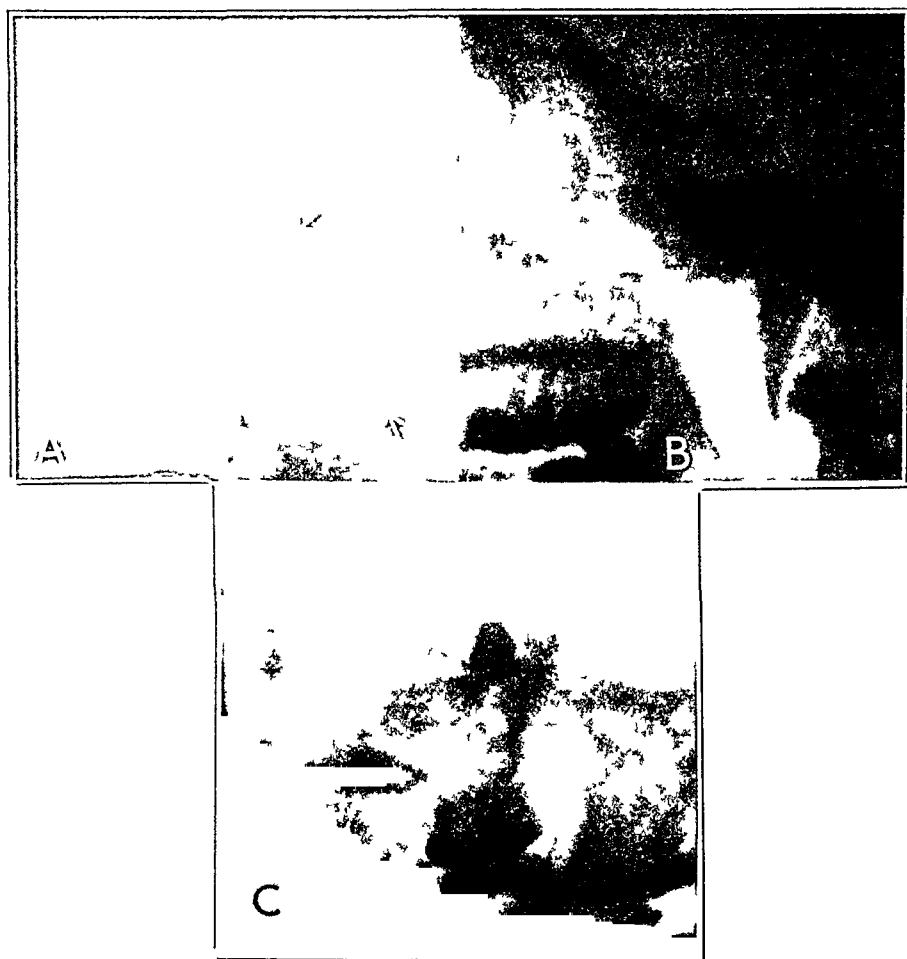


Fig. 8 (case 6, Miss C, diagnosis, asthma and pansinusitis, polypi were found in all the sinuses at operation and transient attacks of amaurosis occurred in the right eye during severe attacks of asthma) —*A*, anteroposterior roentgenogram, following the injection of radiopaque oil in the right sphenoid sinus with the head in the vertical position. *B*, lateral roentgenogram, with the head in the vertical position. Note the filling defect of the sphenoid sinus. *C*, roentgenogram in the Vail-Lange position showing the marked filling defect of the upper outer angle of the sphenoid sinus. (The nasopharyngoscope passed into the right sphenoid sinus several months after operation demonstrated the presence of polypi, chiefly on the roof and in the upper outer angle of the sinus.)

The acuteness or chronicity of the sinusitis was determined by the history and clinical indications as follows. Four patients had no symptoms or history of sinusitis. Six patients had symptoms and a history suggesting an acute sinusitis. Five patients had symptoms and a history suggesting chronic sinusitis. One of these was a patient who, for nearly two years, had had with every cold a unilateral diminution of vision, at times severe, but with a clearing up of the blindness when the cold improved. Roentgen examination of the nasal sinuses following the injection of iodized poppy seed oil 40 per cent showed filling defects of the maxillary sinus and the sphenoid sinus on the side of the affected eye.

An interesting point was found on study of the case histories. Eleven of the fifteen cases occurred in the fall, winter and spring months, two in May and one in July. The chronic recurrent case could not be classified.

TABLE 2—*The Relation Between the Etiology and the Extent of the Condition*

	Unilateral			Bilateral				
	Origin in Nasal Sinus	Multiple Sclerosis	Lead Poisoning	Origin in Nasal Sinus	Syphilis	Tobacco	Quinine	Pernicious Anemia
Cases	12	1	1	3	2	2	1	1
Per cent	80	100	100	20	100	100	100	100

Most interesting, I believe, of all the observations was the fact that in the cases in which the onset was acute and could be definitely dated, the blindness was noticed after a night's sleep. In five of the cases, the course was so gradual that no definite date of onset could be given by the patient. The recurrent case could not be included in this grouping.

I shall report in detail one of the most interesting of the cases.

REPORT OF A CASE

Mrs. A. A., aged 46, was first seen on March 10, 1922. She stated that one month previously, she had noticed the gradual onset and progress of defective vision in both eyes. She was not subject to colds, but about a month before, had one that lasted for three days. She had no severe headaches. Within the past eight months, she had noticed a little dizziness. Her memory had been poor for several years, but there had been no recent change. For eight months she had noticed numbness in both hands and feet. Her general health had been only fairly good.

Ophthalmoscopic examination (by Dr. D. T. Vail, Sr.) showed. On March 10, 1922, there was some swelling of both optic disks, with swelling of the retina about the disk. The macular regions were normal. In the right eye vision was 20/200, and in the left, perception of fingers at 2 feet. The visual field in each eye showed a central scotoma. The diagnosis was acute neuroretinitis (bilateral).

Urinalysis showed the smallest possible trace of albumin. The blood pressure was normal. A general physical examination (by Dr Grewe of Cincinnati) showed nothing definite, although the patient was not in good health. The Wassermann reaction was negative. A lumbar puncture (by Dr Faller of Cincinnati) showed the spinal fluid under increased pressure and globulin +1. No cell count was recorded. Neurologic examination gave normal results.



Fig 9—Photomicrograph showing the relations between the sphenoid sinus mucosa (*A*) and the optic nerve (*B*). This section shows a very compact bony wall (*C*) between the sphenoid sinus mucosa and the dural sheath of the optic nerve, and is analogous to figure 5 in Professor Herzog's article, *Ueber die Neuritis and retrobulbaris* (*Arch f Augenh* 99 292 [July] 1928).

There was slight deviation of the nasal septum with no obstruction to breathing. Both middle turbinates were enlarged. The nasopharynx was clear and no pus was seen in the nose. Transillumination showed both antrums bright.

A roentgen examination (by Dr Sidney Lange of Cincinnati) showed that the frontal sinuses and antrums were clear. There was slight clouding of the right posterior ethmoid region. The sphenoid sinuses were clear.

My first impression of the case was that the retrobulbar optic neuritis did not originate in the nasal sinuses. However, when all the other possible causes seemed to be excluded, the posterior sinuses were operated on on March 17, 1922. Under ether anesthesia, a submucous resection of the septum was done. The left middle turbinate was removed, and the left posterior ethmoid cells were opened back to the sphenoid sinus. A large opening was made in the front wall of the latter. The mucosa of the sphenoid sinus was grayish. No disease was seen in the sphenoid sinus on inspection through the Holmes nasopharyngoscope passed into the cavity. The same procedure was used on the right side, and a complete absence of disease in the posterior sinuses was noted.

On the following day the patient stated that vision seemed brighter. Two days after operation, vision was 20/200 in the right eye and perception of fingers

TABLE 3—*Observations on the Fundus, Field and Vision in Fifteen Cases Originating in Nasal Sinuses*

Fundus			Central Scotoma	Peripheral Field	Visual Disturbance		
Normal	Optic Neuritis	Sectional Atrophy			Mild	Moderate	Severe
8	5	2	15	Normal in all	5	1	9

TABLE 4—*Seasonal Prevalence and Type of Infection*

Extreme Ages	Males	Females	Acute Sinusitis	Chronic Sinusitis	No Symptoms of Sinusitis	Seasonal Prevalence
12-58 yrs	7	8	6	5	4	5 in March 2 in April 2 in May 1 in December 1 in January 1 in February 1 in July 1 in September 1 recurrent case

at 5 feet in the left eye, after six days fingers were perceived by the left eye at 6 feet, after eight days, at 15 feet, and after ten days, at 18 feet, vision in the right eye remaining 20/200. At this time, Dr. D. T. Vail, Sr., noted that the optic neuritis and retinitis were disappearing.

Five weeks after operation, vision was 20/200 in the right eye and 20/200 in the left, two months afterward, 20/40 in the right eye and 20/100 in the left, and seven months afterward 20/20 in the right eye and 20/30+ in the left. Dr. D. T. Vail, Sr., noted slight optic atrophy on the temporal side of both disks.

Thirteen months after operation, vision was 20/20 in both eyes.

The patient was seen at irregular intervals during the ensuing years. Recently, almost eight years after operation, she wrote that her eyesight was normal and that, outside of a sluggish liver, she was doing well.

Comment—A diagnosis of multiple sclerosis could not be made definitely in this case, yet it seemed that there was some disturbance of the central nervous system. The spinal fluid was under increased pressure. If operation had not been performed, would this case have



Fig 10—Higher magnification of the same section to show the very compact structure of the bony wall (*B*) between the sinus mucosa (*A*) and the dural sheath of the optic nerve (*C*). Figures 9 and 10 were made through the cooperation of Dr M Herzberg, pathologist, Jewish Hospital, Cincinnati, and Mr J B Homan, assistant professor of medical art, College of Medicine, University of Cincinnati.

progressed to multiple sclerosis at a later date? Or must more years pass before the diagnosis is proved or disproved?

I did not make a roentgen examination of the optic canals until 1924, as White¹⁰ did not publish his work on that subject until 1923. The cases in which this special roentgen examination was made showed no definite indications. Very large and average-sized canals were found in patients whose vision was severely affected. I never considered the size of the optic canal the deciding factor as to when to operate.

TABLE 5—*Onset of Condition*

Cases	Acute 9 (Onset definitely occurred during night)	Gradual, Undetermined 5	Recurrent 1 (Gradual onset with colds, cleared up as colds improved)
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TABLE 6—*Roentgen Observations on the Nasal Sinuses and Optic Canals**

Cases	Clouding of Ethmoids 5	Clear Sinuses 10	Large Sphenoid Sinus 15
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* The optic canals were uniformly measured in the last nine cases (those seen since 1924), in several severe cases large or average sized canals were found.

TABLE 7—*Gross Pathologic Observations on the Sinuses at Operation in Nine Cases (Three Bilateral)**

Cases	Normal 8	Polypi, Pus, Inflammation, etc 1
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* The operation consisted of submucous resection of the nasal septum, posterior ethmoidectomy and opening the sphenoid sinus. The presence or absence of pathologic changes in the sphenoid sinus was determined by the inspection of the interior of the sinus by means of a nasopharyngoscope passed through the operative opening.

I believe that the size of the optic canal does not determine the vulnerability of the optic nerve. In my opinion, this is determined by the structure of the wall between the optic nerve and the sphenoid or posterior ethmoid sinuses.

Heizog, as already mentioned, found in microscopic sections a marked difference in the structure of this bony wall. Some of the walls had a dense, nonporous structure, others, large spongelike marrow spaces. In the marrow spaces he found a union of the deeper layers of the submucosa of the nasal sinuses and cellular elements given off from the dural sheath of the optic nerve.

¹⁰ White, Leon. An Anatomical X-Ray Study of the Optic Canal in Cases of Optic Nerve Involvement, Boston M & S J 189:741 (Nov. 15) 1923.

When I read his work, I was immediately impressed with the great possibilities of this fact as explaining the mechanism of the production of retrobulbar neuritis originating in the nasal sinuses, and it seemed to me that if a method could be found which would demonstrate on the living patient the thickness of the bony wall between the optic nerve and the sphenoid sinus, such a method might prove valuable.

My method of determining the thickness of the bony wall between the optic nerve and the sphenoid sinus is to fill the latter with a radiopaque oil, using a blunt cannula inserted through the ostium, and to place the patient so that the oil gravitates to the upper outer angle of the sphenoid sinus. With the head in this position, the roentgen rays are passed through the skull in the same plane as that described by Leon White in his roentgenologic study of the optic canals.

ROENTGEN TECHNIC

Dr. Sidney Lange's roentgen technic for the Vail-Lange visualization of the wall between the sphenoid sinus and the optic canal is

Right Sphenoid Sinus—After iodized poppy seed oil 40 per cent has been introduced into the right sphenoid sinus, the patient lies on a flat table either prone or partially on the right side (if he has a short rigid neck). A pillow or sandbag is placed under the upper part of the chest to elevate the shoulders slightly, so that the head can be angulated downward (flexed) slightly.

A cassette, 8 by 10 inches (20 by 25 cm), is placed at an angle of 45 degrees and the right side of the face is placed obliquely against it so that the right malar prominence, tip of the nose and point of the chin are in contact with the cassette.

The axis of the x-ray beam is directed through the left parietal eminence and through the center of the right orbit, exactly at right angles to the plane of the cassette.

Using 20 ma. at a $4\frac{1}{2}$ inch spark gap, the time of exposure would be two seconds.

Left Sphenoid Sinus—The position of the head is reversed.

SUMMARY

1 A brief resumé of the literature quoted by Canuyt, Ramadier and Velter would seem to show that retrobulbar optic neuritis of nasal origin has been recognized for several centuries.

2 The pathologic studies of Professor Herzog, of Innsbruck, are quoted, and his belief is emphasized that they will explain in every way the mechanism of the production of retrobulbar optic neuritis from posterior nasal sinusitis.

3 Statistics of various authors are quoted to show that the incidence of retrobulbar optic neuritis originating in the nasal sinuses varies according to the particular author's acceptance or denial of a nasal sinus etiology of retrobulbar optic neuritis.

4 A series of fifteen cases of retrobulbar optic neuritis of nasal origin seen by me are tabulated

5 An important observation is made, namely, that when the onset of blindness was acute and could be definitely dated, it was always noticed after awakening from sleep. The position of the head in sleeping favors the gravitation of infection to the upper outer angle of the sphenoid sinus where the optic nerve is in closest relation

TABLE 8—*Final Visual Acuity*

	No Operation (6 Cases)		Operation (9 Cases)		
	No Treatment	Recovery, Vision 20/25 or Better	Complete Recovery, Vision 20/20	Slight Improvement Vision 20/30	Slight Improvement Vision 20/100 or Less
Cases	3*	3	7†	1	1‡
Per cent	50	50	77	11.1	11.1

* One of these patients (the recurrent case) would not consent to operation

† This includes one of the bilateral cases, vision in one eye was 20/20, in the other, 20/100

‡ This does not include one of the bilateral cases, vision in one eye was 20/100, in the other eye, 20/20

6 Statistics are quoted to show that the ocular symptoms constitute an early indication of multiple sclerosis in only 14 per cent of the cases, and the opinion is stressed that the virus of multiple sclerosis may gain entrance to the central nervous system from the sphenoid sinus in the same way that organisms have been shown to do. If this is a fact, it would immediately indicate that an early operation on the posterior sinuses should be performed in cases of multiple sclerosis

7 A new method is described of roentgen visualization of the relations between the optic canal and the sphenoid sinus by means of filling the sinus with radiopaque oil and so placing the patient's head that the upper outer angle of the sinus is dependent. Thus, the radiopaque oil comes into contact with the boundary of the sphenoid sinus where it is most closely related to the optic nerve. In no other position can this be shown

Clinical Notes

MALIGNANT NEUTROPENIA (AGRANULOCYTOSIS)

Report of a Case with Apparent Recovery *

E G GILL, M D, ROANOKE, VA

The term agranulocytosis¹ has come into the literature because of its brevity. The name is not strictly correct. "Agranulocyte" was the term originally chosen for neutrophils in leukemia without granulations, and by the term "agranulocytosis" is meant an increase in these atypical neutrophils, this was not intended. The increase of monocytes accompanying this extreme injury of neutrophils is important, a fact that speaks against Naegeli's myelogenic genesis. The bone marrow is degenerated to a great extent, it is liquid, with few cells, most of which are plasma cells and lymphocytes, and it is practically without agranulocytes.

Since similar blood pictures have been obtained experimentally in anaphylaxis (by myself and Miss Loewe), it seems possible that agranulocytosis is an anaphylactic condition instead of an individual disease. In the anamnesis of the condition cases of angina, grip, etc., are often found. At present the name applied by Tuerk, "malignant neutropenia," seems to be more appropriate.

The syndrome of agranulocytosis with angina is threefold: ² (1) an acute systemic infection with prostrating fever, (2) a markedly low number of white cells and greatly diminished or absent polymorphonuclears, the other blood elements, including the platelets, relatively normal, and (3) ulcerative and necrotic lesions of the oropharynx, including the lips, gums, tongue, pillars, tonsils, pharynx and sometimes the intestinal tract and genital areas.

The condition appears at any age, and the majority of cases occur in women. It has no significant racial, geographic epidemic or contagious incidence. In about half of the cases reported, jaundice developed as the disease progressed.

It is not known whether this condition is due to a congenital deficiency in the bone marrow and an endocrine imbalance of the spinal cord function, or to a complete paralysis of function as expressed by Zilowsky³ "sepsis in a weakened organism resulting in an injury to leukopoietic system, paralysis of the organ complex, liver, spleen and endocrine secretions which stimulate the bone marrow and regulate the entrance of granular cells into the blood stream." The essential pathologic changes appear in the red bone marrow. In agranulocytosis, the portion of the marrow that produces agranulocytes is completely suppressed—in normal conditions, the life of this cell is from three to five days—while the portion of the marrow that produces the erythrocytes and platelets continues to

* Submitted for publication, March 18, 1931

1 Schilling, Victor. The Blood Picture and Its Clinical Significance (Including Tropical Diseases). A Guidebook on the Microscopy of Blood, St. Louis, C. V. Mosby & Company, 1929.

2 Babbitt, J. A. and Fitz-Hugh, T. Jr. Agranulocytic Angina, Report of a Case with Apparent Recovery. Arch. Otolaryng. **12** 439 (Oct.) 1930.

3 Zilowsky, quoted by Babbitt and Fitz-Hugh (footnote 2).

function normally. It is not known why one portion of the bone marrow should be paralyzed while the other continues to function normally. It is also not known whether the pathologic condition in the bone marrow precedes or follows a local infection. Certainly, in some cases, the patient is ill before the development of local lesions is detected, but how is one to account for the condition of the blood marrow?

Vincent's organisms are frequently found in cultures taken from the ulcerative lesions, but not to an extent that would prove them to be a definite etiologic factor. Cultures of the blood fall in the same category. Some physicians have attached significance to the fact that many attacks of agranulocytosis have been preceded by shock, including fractures of the bone with accompanying cellulitis, by the extraction of teeth, the administration of neoarsphenamine, vaccination for typhoid, arthritis and the removal of the thyroid gland.

The condition frequently passes for diphtheria, Vincent's angina, syphilis or a streptococcic sore throat. An examination of the blood, however, will establish the diagnosis, and in cases with ulcerative lesions of the mouth and throat, careful smears, cultures and examinations of the blood should be made.

Many different types of treatment have been employed. The best results seem to follow repeated transfusions of blood, stimulating irradiation over the long bones and local treatment for the lesions of the mouth and throat, combined with a supportive diet rich in vitamins.

In the following case apparent recovery from malignant neutropenia occurred.

A farmer, aged 57, had been in good health until Nov. 20, 1930, when he began to have chilly sensations which continued for three days. On the fourth day, the chills were severe and frequent, and at this time severe pain developed in the entire left side of the jaw and in the face and temporal region. The condition grew progressively worse until his admission to the hospital on December 10, when he presented an appearance of extreme prostration.

His chief complaint was severe pain in the left side of the jaw and in the face and temporal region. On admission, the temperature and pulse rate were normal. Six hours later he had a chill that lasted for twenty minutes, and his temperature rose to 104 F. Physical examination gave negative results, except for jaundice, which was definite. The paranasal sinuses were clear. There were two small, superficial ulcers on the margins of the gums, smears from which showed *Staphylococcus aureus*. On admission, the examination of the blood showed coagulation time, one minute, white cells, 1,950, red cells, 4,320,000, hemoglobin, 90 per cent, polymorphonuclear neutrophils, 18 per cent, and lymphocytes, 82 per cent.

The patient was given a transfusion of 500 cc of whole blood, without any reaction. The pain in the left side of the jaw and face was immediately relieved. For two days his condition improved. On the third day following the transfusion of blood, there was marked pain in the jaw and face, and his general condition was worse. An examination of the blood after the transfusion showed white cells, 4,900, red cells, 4,500,000, polymorphonuclear neutrophils, 36 per cent, lymphocytes, 57 per cent, eosinophils, 5 per cent, basophils, 3 per cent, and lymphoblasts, 1 per cent. Four days following the first transfusion of blood, 500 cc of whole blood was again given, without reaction. The patient's general condition improved immediately and continued to do so. On December 23, he was discharged from the hospital free from symptoms and with a normal blood count.

SUMMARY

As a recurrence of malignant neutropenia should always be considered, this case is reported as one of apparent recovery. When seen two months after leaving the hospital, the patient was well and attending to the duties of his farm. An examination of his blood showed that it was normal.

The most striking features of this case, other than the blood picture, were the extreme prostration, marked jaundice and severe pain in the left side of the jaw and in the face. The treatment consisted of two transfusions of blood and large doses of cod liver oil and glycerite extract of red bone marrow by mouth. With few exceptions the course and prognosis of this disease are usually short, severe and fatal.

Progress in Otolaryngology

A Summary of the Bibliographic Material Available in the Field of Otolaryngology

TONSILS AND ADENOIDS

FRENCH K HANSEL, M D
ST LOUIS

In reviewing the literature for 1930 on the tonsils and the adenoids, I have selected only those papers which promote discussion and those which, according to my judgment, show the advances made in this particular field of otolaryngology during the past year. Interesting papers by Monroe and Volk, McLean and Kaiser were directed toward the study of large groups of children for the results of tonsillectomy. A great deal of interest has been exhibited in the consideration of the complications of tonsillectomy. A symposium on the subject of pulmonary abscess following tonsillectomy, which was given before the American Bronchoscopic Society, considered all phases of this subject in a comprehensive manner. Other complications of tonsillectomy, such as thrombophlebitis of the internal jugular vein, pyemia, deep cervical infection and parapharyngeal abscess, were presented by various authors in several interesting papers. In the treatment of the tonsils, renewed interest has been exhibited in the use of electrocoagulation and irradiation. Several new instruments have been designed and described.

GENERAL CONSIDERATIONS

Monroe and Volk analyzed the complaints of 736 children before and after operation, and compared the results with an analysis of the complaints of 741 children in a control group having similar symptoms on examination and reexamination one year later. The following conclusions are drawn. Tonsillectomy offers a child considerable relief from such common conditions as sore throat, head colds and breathing through the mouth. It reduces malnutrition and promotes the disappearance of enlarged cervical glands. Complaints have been relieved in 91 per cent of patients operated on. In order to obtain the maximum benefit, the child should be operated on in early childhood. Improvement followed operation in 40 per cent of children with subnormal mentality and showing retarded progress in school resulting from enlarged tonsils and adenoids. In the 736 cases analyzed coexisting conditions were present in 120. The control group of cases did not

show any improvement during the one year of observation, as compared with 91 per cent of improvement in the group of patients operated on

In an article on the incidence of recurrent respiratory infections in childhood, McLean stated that recurrent respiratory infections were prevalent in both the patients who had had the tonsils and adenoids removed and in those who had not undergone the operation. Of the children under 3 years of age with recurrent respiratory infections, only 6 per cent had had the tonsils and adenoids removed. Of the children over 3 years of age with recurrent respiratory infections, 49 per cent had had the operation. The variation in the percentage of the recurrent incidence, according to ages in children who had had tonsillectomy and adenoidectomy can be explained by the fact that many children over 3 years of age have had the operation while very few of the younger children have had the tonsils and adenoids removed.

After a comparative study of 2 200 tonsillectomized children with an equal number of controls three and ten years after operation, Kaiser reported the following interesting conclusions:

- 1 The real value of the removal of tonsils and adenoids cannot be definitely established in a few years. Apparent benefits during the first few postoperative years are not so evident over a ten year period.

- 2 Outstanding benefits are apparent in influencing the incidence of sore throats over a ten year period.

- 3 Substantial benefits are apparent in rendering children less susceptible to scarlet fever and diphtheria.

- 4 Acute head colds and otitis media, though definitely lessened over a three year period, are not essentially influenced over a ten year follow-up period.

- 5 Cervical adenitis is decidedly reduced in tonsillectomized children over a ten year period.

- 6 The respiratory infections, such as laryngitis, bronchitis, and pneumonia, not only are not benefited but actually occur more frequently in tonsillectomized children.

- 7 First attacks of rheumatic manifestations occur from 30 to 50 per cent less often in tonsillectomized children. The greatest reduction occurs in children tonsillectomized early. Recurrent attacks are not benefited at all.

- 8 Incomplete tonsillectomies do not offer the same protection against the usual throat complaints and infections as complete removal of tonsils.

- 9 The hazards of tonsillectomy must be considered in evaluating the end-results. Considering this hazard, the late results seen in 2,200 children ten years after operation are evident only in the reduction of sore throat, cervical adenitis, otitis media, scarlet fever, diphtheria and rheumatic fever and heart disease.

In a statistical study of the children in public schools for the deaf, Shambaugh, Hayden, Hagens and Watkins reported on the relation of tonsils and adenoids to lesions of the middle ear. Among the children examined, 2,355, or 44.03 per cent, had their tonsils and adenoids removed, 2,638, or 49.32 per cent, still had the tonsils and for 355 no

record was made regarding the tonsils. Of the children who had had the tonsils and adenoids removed, 1,377 showed no palpable evidence of having had disease of the middle ear. Of the children with tonsils still in situ, 1,062 showed palpable evidence of disease of the middle ear and in 1,576 such evidence was absent. Disease of the tonsils and adenoids can be responsible for severe deafness only when it has produced otitis media which has invaded the labyrinth—a negligible factor in these statistics.

From a clinical and roentgenologic study of 174 children with hypertrophy of the tonsils necessitating operation and of 100 children without enlargement, Hofer concluded that there is no connection between tuberculosis of the tracheobronchial lymph nodes and hypertrophy of the tonsils. He did not favor the theory propounded by many authors that enlargement or tuberculosis of the tracheobronchial lymph nodes with coincident hypertrophy of the pharyngeal tonsils is due to a descending infection of the lymphatic system. Hypertrophy of the pharyngeal tonsils is related to tuberculosis in children so far as inhibition of nasal breathing leads to a chronic bronchitis, which, according to statistics, is responsible for concurrent infection by tuberculosis in 95 per cent of cases. Very few cases are known in which tuberculosis of the pharyngeal tonsils is primary to tuberculous lymph nodes. In four fifths of Hofer's cases hypertrophy of the pharyngeal tonsils was coincident with an enlargement of the cervical lymph nodes. Hypertrophy of the palatine tonsil was almost invariably attended by hypertrophy of the cervical lymph nodes. Enlargement of the cervical glands without hypertrophy of the tonsils may be referred to scrofula and lymphatic diathesis. If indications for adenotomy, tonsillectomy or tonsillotomy are given, these operations should be performed, according to Hofer, in spite of a positive cutreaction for tuberculosis and positive results in roentgen examination. The effect of the operation on the pulmonary condition is invariably favorable and may be continuous.

In the literature on the subject of tonsils and adenoids reviewed it is remarkable that little if any attention has been paid to the adenoids. In an interesting and comprehensive report on nasopharyngeal abscess, Yankauer reviewed his series of 155 cases. He pointed out the difference between nasopharyngeal abscess and Thornwaldt's disease. He referred to Thornwaldt's original report, an analysis of which showed that the latter's cases were cases of nasopharyngeal abscess and not pharyngeal buisitis. Nasopharyngeal abscess arises from the recessus medius of the adenoid. Yankauer has devised a direct speculum for examination of the nasopharynx. The largest number of cases occurred in patients between the ages of 20 and 30 (72 of 155 cases), 32 cases occurred in persons between the ages of 30 and 40. An

abscess in the adenoid is characterized by the presence of a swelling in the region of the recessus medius, but the swelling may not manifest itself as a rounded protuberance, but merely as an elevation of the concavity of the vault of the nasopharynx, a flattening out of the concave surface. The swellings do not always contain pus and the diagnosis is not complete until the swelling is opened and the contents are noted. Of 142 cases in which the contents were noted, 121, or 86 per cent, showed thick creamy pus. Yankauer described the symptoms produced by these abscesses. It is particularly interesting that headaches may be caused by these infections. Yankauer's interesting report should prompt the rhinologist to be more careful in the examination of the nasopharynx to determine the presence or absence of nasopharyngeal abscess.

Bradley has made an attempt to assess the value of the tonsil-adenoid operation in the prevention of epidemic nasopharyngeal infections. The operation was found to be of no appreciable value, but some evidence was produced to show that it is followed by compensatory hypertrophy of other lymphoid tissue in the presence of acute disease of the upper passages. The conditions found suggest that, until the loss of lymphoid tissue is made good, patients who have been operated on are more susceptible to the common catarrhs and more frequently attacked by complications. Chronic tonsillitis is a complication of acute nasopharyngitis. Autogenous reinfection from septic tonsils is not common. It is discussed and the necessity for operation in these circumstances emphasized. A distinctive type of epidemic sore throat is described. Tentative statistical proof is presented that coryza and febricula are "formes frustes" of the stationary fevers in a community.

Miller discussed disease of the lingual tonsil and called attention to the fact that it is frequently overlooked in examination of the throat. Hypertrophy is the most common disease, but acute and chronic infections occur with fair frequency. The incidence of involvement seems greater in men than in women, and may occur in infancy. The best treatment for chronic involvement of the lingual tonsil is surgical removal, though the use of the galvanocautery is of decided value.

It was suggested by Jerwood that maternal mortality might be reduced by eradicating focal sepsis preferably before pregnancy has occurred. The tonsils are the commonest site of focal sepsis in young adults, and therefore in most pregnant women. Just as influenza and nasopharyngeal catarrhs constitute an overwhelming majority of the acute illnesses encountered in general practice, so chronic sepsis of the upper respiratory tract lies at the root of most chronic debilities.

Snoke reported a case of lympho-epithelioma involving both tonsils. On first examination the left tonsil only was involved. This was treated with radium. Two years later the right tonsil became involved. At this time nodules were noted at the inner canthus of the left eye in the

pharynx and nasopharynx Pathologic examination of the tonsils showed a lympho-epithelioma Unfortunately, blood counts were not recorded in this case Tumors of a similar nature were reported a few years before by New in cases of chronic lymphatic leukemia

ANATOMY AND PHYSIOLOGY

The surface of the tonsils is not indicative of their pathologic condition according to Heiberg It is only by microscopic examination of the adenoid tissue that the severity of infection of the organism may be inferred and a guide in prognosis found The centers of phagocytic activities (or germinal centers) especially show variations of structure which have been found to correspond to the degree of involvement They are larger in the healthy organism, which indicates a metabolic relation Heiberg referred to his previous papers on this subject In a study of 100 cases in which operation was performed at the Finsen Institute, Heiberg did not find any difference in the behavior of pharyngeal and palatine tonsils The activity of the germinal centers, according to Heiberg, appears to lie in the direction of the destruction of lymphocytes, whereas production of the latter takes place in other parts of the tissue The lymphocyte cap surmounting the germinal centers is larger if these are defective, and several distinct types may be distinguished in their organization The structure of the lymphocytic nuclei is more highly differentiated in the adenoid tissue than in the lymphocytes of the blood or in those seen in infiltrations surrounding the blood vessels in acute inflammations Greater development of the interstitial tissue is found in infections However, the rôle of immunity and metabolism is not yet clearly defined Heiberg pointed to the substance that was isolated by von Schmidt, in 1927, from the germinal centers of the tonsils It was found to be thermostabile in acids after removal of the proteins, and it caused lymphopenia after subcutaneous injection Stimulation of the tonsils by "massage" has likewise caused lymphopenia

In a study of the position of the deeper vessels of the neck in relation to the end of the needle in local anesthesia around the tonsil, Stout concluded that the large vessels of the neck are sometimes in close proximity to the tonsil The usual type of needle used is sufficiently long to reach these vessels Veins are more easily pierced than arteries, and sharp needles enter the vessels more easily than round pointed ones The lack of resistance encountered in injections of a local anesthetic suggests the likelihood of injection into a vessel This may account for some of the marked symptoms that sometimes follow the injections

BACTERIOLOGY AND PATHOLOGY

In 400 tonsillar cultures examined by Cobe staphylococci were the predominating organisms The streptococci followed the pneumococci

in predominance, with hemolytic streptococci the principal members of the group. Three per cent of the nonhemolytic streptococci recovered were classed as *Streptococcus cardio-arthritidis*. There appears to be a definite relationship between the type of organism recovered from tonsillar cultures and the age of the patient, streptococci being more common in younger patients (under 11 years of age). There was a definite seasonal difference in the organisms recovered from tonsillar cultures, *Bacillus influenzae*, *Bacillus mucosus-capsulatus* and the diphtheroid types being more prevalent in the spring, and *Micrococcus catarrhalis* more prevalent in the fall.

Brandes' experiments were made with toxins of streptococci isolated from five patients with acute articular rheumatism and from a patient with chronic articular rheumatism. Twice the condition was associated with acute tonsillitis, twice the patient's history revealed recurring sore throat, and twice chronic tonsillitis was present. Liver bouillon was used for cultures, it contained 1,000 cc of liquid, 500 Gm of liver, 12.5 Gm of a proprietary dry peptone and 5 Gm of sodium chloride. After sterilization, a 30 per cent solution of sodium carbonate was added until red litmus paper became slightly blue. The central portion of the tonsils was repeatedly washed in a physiologic solution of sodium chloride and then ground into a pap which was cultivated on the bouillon and on blood agar. The culture tubes were kept in the incubator for from one to thirty-five days. From 3 to 31 cc of the culture was introduced into the marginal auricular vein of rabbits at once or in repeated injections. In thirteen of the thirty-nine animals thus inoculated, lesions developed in the joints, there was a seromucous exudate which contained polymorphonuclear leukocytes and an increased number of large mononuclear cells. The changes in the joints resembled those in cases of rheumatic polyarthritis in man, but the swelling of the joints was never pronounced. The results suggest that toxins of hemolytic streptococci may possibly be the causal factor of articular rheumatism in man.

Castellani said that diseases of the tonsils due to fungi are not rare though so far scant attention has been paid to them. They may be classified in various ways. Castellani presented a clinical classification as probably the most useful for practitioners. According to this classification tonsillomycoses are separated into two groups: acute and chronic. Of the acute tonsillomycoses the principal types are tonsillomycosis follicularis and tonsillomycosis membranacea (tonsillomycosis diphtheria-similis). Cases of the latter type may closely resemble those of diphtheria. Of the chronic and subacute tonsillomycoses the principal types are tonsillo-actinomycosis, tonsillopseudo-actinomycosis, tonsillomycosis fusca and tonsillomycosis spiculata vel spinulosa.

By the use of penicillin hemoglobinophilic bacilli were isolated by Fleming and MacLean from the gums of 30 healthy nurses and students

and from the tonsils and postnasal spaces of almost all of these. The majority of the strains isolated were nonhemolytic, but hemolytic strains were found in all situations. Para-influenza as well as influenza bacilli were isolated from all these situations. A bacillus agreeing in its (growth) requirements with *Bacillus haemoglobinophilus* was isolated from the gums of 1 person. From the gums of 6 laboratory workers who were studied carefully both influenza and para-influenza bacilli were isolated. The hemoglobinophilic bacteria isolated were variable in their cultural and morphologic characteristics. A type of para-influenza bacillus that was constantly found in the gums was described. From the apexes of infected teeth, hemoglobinophilic bacilli were isolated in 3 of 4 cases. The methods of using penicillin for the isolation of influenza bacilli are described.

Castellani discovered that fetor oris of tonsillar origin is always associated with the presence of two bacilli for which he proposed the names *Bacillus colofetidus* and *Bacillus alkalofetidus*.

In an article on mixed chancre of the tonsil Vialle, LeCocq and Ronchese reported two cases in which Vincent's spirillum and the fusiform bacillus attacked syphilitic lesions of the tonsil causing lesions that simulated neoplasms and that were of extreme discomfort and danger to the patient. They suggested the desirability of tests for syphilis in all ulcerative lesions of the tonsil no matter what the smear or dark field may show.

In a study of the pathogenic tonsil Guttman found that by gentle massage of the tonsils certain patients revealed an increased white blood cell count while others showed a decreased count. In attempting to standardize the results of this manipulation he came to the following conclusions: 1. Massage of the empty fossae of tonsillectomized patients causes little or no change in the white count of the peripheral blood. 2. Hyperplastic tonsils when not accompanied by infection, cause a fall in the white count. 3. Massage of a chronically infected tonsil causes a rise in the white cell count thus serving as a basis for a biologic reaction from which the pathogenic status of the tonsil may be determined. A healed and noninfective tonsil will not react in this manner. 4. The test is contraindicated in the presence of an acute or a subacute process in the tonsils or in a systemic disturbance that may be predicated on a tonsillar infection.

COMPLICATIONS

During the past year a number of interesting reports have appeared on the subject of pulmonary abscess following tonsillectomy. In a symposium Clerf, Carmody, Pierson, Holman and Schall discussed the various aspects of the subject. Clerf reported a group of 77 cases. Fifty or 65 per cent occurred in patients between the ages of 20 and 40. This corresponds rather closely to the age-abscess incidence of pulmonary

abscess in all cases. In 4 cases local anesthesia, and in 73 cases general anesthesia, was used. In 48 cases (62 per cent) the right lung was involved, and in 28 (37 per cent) the abscess occurred in the left lung, in 1 case the lesion was bilateral. The underlying principles in the treatment for pulmonary abscess irrespective of the method to be employed, consist of the establishment and maintenance of adequate drainage. Cleif advocated bronchoscopy early in the course of the disease, 38 patients were ultimately discharged as well after a course of bronchoscopic treatment. The average duration of the abscess before treatment was four and one-half months. In 27 cases the duration was three months or less, in 5 cases it was more than one year. No definite rules can be laid down with regard to the length of time bronchoscopy should be continued, every case of abscess of the lung should be considered individually by the internist, roentgenologist, surgeon and bronchoscopist to determine the form of treatment to be employed.

In discussing the laryngologic aspect of pulmonary abscess following tonsillectomy Carmody gave a brief but interesting history of infection of the lung as being derived from the upper respiratory tract. He called attention to the fact that textbooks on diseases of the nose and throat give little consideration to this subject. The theories of origin of pulmonary abscess were considered. The embolic and aspiratory routes were described. Bronchoscopic evidence points to aspiration of septic material from the upper respiratory tract as the most common cause.

In the consideration of the medical aspects of posttonsillectomic pulmonary abscess Pierson defined this type of condition as characterized by consolidation and necrosis. The complication generally begins from twenty-four to forty-eight hours after operation and is characterized by fever, sweats, anorexia, malaise and a dry harassing cough terminating, in from ten to fourteen days, with foul expectoration. In summarizing the medical aspects Pierson emphasized the following points:

Pulmonary abscesses follow, although not frequently, operation on the upper respiratory tract and teeth, and may be produced by aspiration or emboli. The anaerobes may be of particular importance in the formation of abscesses in otherwise merely pneumonic processes. Physical signs are less helpful than a carefully secured history and a series of roentgenograms in the diagnosis and management of the disease. The bronchoscopist and surgeon are most important members of the team, and should frequently be in consultation with the internist. Medical treatment offers a much brighter outlook per se and as a preparation for operation than was the case in early surgical procedures. Some abscesses may be prevented by thorough examination of the patient to rule out acute and localized pulmonary disease and by more attention to hygiene of the mouth before and after operation.

In discussing the factors of healing in posttonsillectomic pulmonary abscess Holman stated:

As knowledge in the treatment of patients with intrapulmonary abscess is gained and recorded, it becomes increasingly evident that there are various routes

which may be, and which sometimes must be, traversed before ultimate recovery from such an abscess is achieved. The most favorable time for the cure of the abscess is during the period immediately following its inception, and the treatment then will necessarily be different from that attempted at a later stage when the thickened, rigid walls of the abscess present one of the most baffling problems in surgery.

As to its development, an intrapulmonary abscess may be produced by the destruction and liquefaction of pulmonary tissue through the action of infecting organisms. These organisms may reach the lung by way of the bronchi or the blood stream.

Whatever may be the origin of the infecting organism, whether through the blood stream or the bronchi, the resulting destruction of pulmonary tissue leaves a dead space—the abscess cavity—which must be obliterated. The three important factors in the obliteration of this cavity are (1) adequate drainage, (2) the gradual contraction of fibrous tissue laid down as granulations in the wall forming the abscess and (3) the expansion of the healthy normal lung to replace the destroyed lung.

Bronchoscopic considerations as an aid to the surgeon are presented by Schall, who concluded that the bronchoscopist is of aid to the thoracic surgeon in localization of the abscess (1) by following the pus stream to its source and (2) by pneumography. The bronchoscopist can improve drainage by the dilation of strictures and by the removal of granulation tissue that may obstruct the bronchus. In certain cases, with bronchoscopic sounding the surgeon can open the abscess by cutting down on the bronchoscope.

Hara reported the result of the bronchoscopic study of 110 tonsillectomized patients for evidence of aspiration. He strongly emphasized the desirability of operating on these patients in the modified Trendelenburg position as a means of preventing aspiration.

In a discussion of the complications of tonsillectomy Hartz gave a comprehensive review of the various important factors to be considered. He emphasized the importance of a complete history and physical examination, and advocated that plenty of time should be allowed for the subsidence of acute infection before tonsillectomy was performed. A routine laboratory procedure for testing the coagulation of the blood, roentgenograms of the chest in suspected cases of disease of the thymus gland, the control of hemorrhage and postoperative care are also emphasized.

According to Dixon and Helwig, thrombophlebitis of the internal jugular vein probably takes first rank as a fatal complication of tonsillitis. These authors reported a group of 8 cases resulting from an extension of an acute and overwhelming infection originating in the tonsil. Trauma to the inflamed tonsillar or peritonsillar tissues pre-

disposes to this complication. In most cases the phlebitis occurs as a complication of the primary attack of tonsillitis, which would indicate a lack of local resistance and a lowered immunity to the infecting organism. Resection of the infected vein and removal of the thrombus are always indicated when a positive diagnosis can be made early enough to warrant intervention.

Goerke directed attention to the fact that a tonsillectomy that is performed to prevent pyemia occasionally may lead to it. He reported a case from his own observation. In a girl, aged 20, who had frequent attacks of tonsillitis, a tonsillectomy was performed ten days after an attack, and pyemia developed. It was the author's opinion that this complication set in because the interval between the tonsillitis and the tonsillectomy was too short. He emphasized that from four to six weeks should elapse after a tonsillar infection before a tonsillectomy is performed. This precaution had been disregarded in this instance because the patient did not wish to lose too much time. In order to prevent infection spread by the needle that is employed for the administration of the local anesthetic, the author advised that several needles be kept in preparation, and that if one penetrated into the tonsillar tissues it should be exchanged for a sterile one. As another prophylactic measure, he emphasized that all carious teeth should be removed or treated before the operation is begun. In order to detect possible latent infections, the temperature should be measured during the last days preceding the tonsillectomy. During the operation itself, sterilization of the hands and instruments is not sufficient. All unnecessary tearing of the tissues should be avoided. Frequent dabbing may also have harmful effects, it will not be necessary if, after the separation of the upper pole, a tampon is placed in the upper tonsillar niche. This tampon should remain until the operation is completed. Tamponade after completion of the surgical intervention is, according to the author's experience, of no significance for the prevention of postoperative infection. However, he advised that the wound be covered with an antiseptic iodine powder, which also has a hemostatic effect. In regard to the treatment for tonsillogenic pyemia, which may have been caused either by tonsillitis or by tonsillectomy, the author stressed the following precautions. Early intervention is necessary. If attacks of chills recur and if other causes may be excluded, treatment should be instituted at once. Cervical mediastinotomy, with exposure of the jugular vein, ligation of the vena fascialis communis and drainage of the parapharyngeal space is recommended. If the facial vein is thrombosed, either excision should be done or the jugular vein should be ligated above and below the place of anastomosis of the vena fascialis communis. If the venous thrombosis is extensive, the thrombosed vessels should be removed following the ligation of the jugular vein. If the jugular vein

itself is diseased, ligation should be done as deeply as possible, the vein should be slit or excised, and ligation should also be done at the base of the skull. If the jugular vein is not involved, it should be let alone.

Thirty cases of deep cervical infection following tonsillectomy, including 3 fatalities, are reported by Shapiro and 80 cases are collected from the literature. In 94 per cent of all the cases reported, the operation was done under local anesthesia. The most important factor in the etiology is the injection of infected solution into the parapharyngeal space. Two clinical varieties are noted: a phlegmonous type, which includes a large majority of all cases analyzed, and a vascular infection, which manifests itself in the form of septicemia, thrombosis or embolism. The phlegmonous form of deep cervical infection following tonsillectomy is characterized by a symptom-complex consisting of trismus, fever and swelling of the neck on the affected side. A large number of grave additional complications are recorded. Shapiro urged that when local anesthesia is used, three points are essential in the prophylaxis: a proper technic of injection, the avoidance of contamination of either the needle or the solution and a minimum period of four weeks between the last acute attack and the operation. The treatment should aim at localizing the infection before an attempt is made to drain the abscess. The incision of choice is through the tonsillar fossa. External operation is indicated under certain conditions.

Weidlein reported an interesting case of chronic abscess of the pharyngomaxillary fossa without symptoms. A deep pocket was present in the pharyngomaxillary region, the outlet of which was discovered accidentally during an operation for the removal of tonsils and which apparently gave no symptoms referable to its presence. The patient had had many previous attacks of peritonsillar abscess. After tonsillectomy the tract was shown roentgenologically by means of the probe and injections of iodized poppy seed oil 40 per cent. In the differential diagnosis a bronchial cyst and abscess were considered. The likelihood of a cyst being present was ruled out on the basis of the fact that there was no discharge from the tract following the operation on the tonsils. It was concluded that the cavity represented an old abscess, probably of tonsillar origin.

Watson-Williams reported 7 cases of parapharyngeal abscess which closely resembled peritonsillar abscess. The most striking difference is the absence of any form of edema of the palatal mucosa. The condition should be suspected when an attack of "quinsy" appears to run an atypical course, or when incision in the usual site on the tonsil fails to reveal pus. The abscess tends to point low in the side of the pharynx behind the posterior faucial pillar where it is permissible to open it under gentle pressure with a blunt instrument.

Two interesting cases of infection involving the pharyngomaxillary space which originated in the tonsils were reported by White. One patient died of meningitis from intracranial extension, and the other recovered after external drainage of this space. White therefore advocated external drainage as recommended by Mosher.

For the alleviation of pain in peritonsillar abscess Guttman described a method that involved cocaineization of the palatine nerves passing through the sphenopalatine ganglion. A topical application of cocaine is made on the lateral wall just posterior to the posterior tip of the middle turbinate. In this manner pain may be controlled and incision of the abscess may be performed with little discomfort to the patient.

Von Hofe reported 3 cases of emphysema of the head and neck complicating tonsillectomy. It seems possible that this condition may be brought about as follows: 1. Air may enter the tissue following perforation of the tonsillar fossa bed. 2. Air may enter the tissues following perforation of pulmonary vesicles. 3. Air may enter the tissues after being forced into Wharton's duct and thence diffused.

A rare complication in a case reported by Hochfilzer was that of phlegmon of the neck and osteomyelitis of the mandible following tonsillectomy.

An interesting report on *Bacillus proteus-vulgaris* infection of the mastoid in 1 case and of the tonsils in 2 cases calls attention to the fact that this infection occurs in the ears and throat as well as elsewhere in the body. The characteristics are a slow, progressive putrefactive necrosis, extreme toxemia and an extraordinary loss of weight. The treatment calls for early drainage and exposure, frequent cleansing and the use of antiseptics rich in oxygen. The prognosis depends on the site of invasion, the virulence of the organism and the individual resistance, but the infection is usually a terminal one.

Ballenger reported 2 cases in which appendicitis developed soon after the removal of the tonsils. A girl, aged 5, was admitted to the hospital with a history of breathing through the mouth, snoring, frequent colds, sore throats and an occasional earache, with two instances of a supervening acute suppurative otitis media. There was no history of a previous attack of appendicitis, a recent cold in the head or sore throat. The tonsils were large and almost met. No acute inflammation of the nose or throat was evident. The tonsils were removed. The second day following the operation, the patient suddenly complained of pain in the abdomen. The pain was accompanied by a rise in temperature to 101 F., and a leukocyte count of 18,000. A diagnosis of acute appendicitis was made, which was confirmed at operation. The second patient, aged 5 years, was admitted to the hospital with a history of frequent colds and sore throat and of breathing through the mouth and snoring most of the time during the past year. The tonsils and adenoids were

large, with no evidence of an acute infection and with no history of a recent cold or sore throat. The tonsils were removed. The day following tonsillectomy she felt well, but during the night of the following day she complained of pain in the abdomen and nausea. Vomiting and fever accompanied the pain. A diagnosis of acute appendicitis was made. The abdomen was opened, and a gangrenous appendix was found with localized peritonitis.

Hyperpyrexia, fatal or not, is a most unusual complication following removal of the tonsils, and only a few cases have been reported. Pearlman and Salinger reported a fatal case coming under their observation and reviewed the literature on the subject. There seems to be no definite agreement as to the etiology of the symptoms of pallor, hyperpyrexia and occasionally death following anesthesia and operation. It would seem unwise, however, to operate on any child with a pre-operative temperature above 99.2 F, one should avoid general anesthesia if possible, and reduce operative manipulations to a minimum.

TREATMENT

Robey and Finland presented evidence that tonsillectomy may be performed during the active stage of acute rheumatic fever without harm to the patient from the operation. Tonsillectomy at that time offers no more dangers than when it is performed under what appear to be the most favorable conditions. Ether was the anesthetic selected for the majority of the 165 cases of this series. The only complication that delayed operation was an accompanying bronchitis or bronchopneumonia. Cardiac conditions practically never contraindicate operation except in extreme cases. The decision to operate was made by internists and not by rhinologists. In several cases in which symptoms have repeatedly recurred, the results of operation have been brilliant.

Levinger performed tonsillectomy on 235 patients with peritonsillar abscesses. In 60 of the patients the operation was immediately preceded by tonsillitis. On the basis of his experiences he came to the conclusion that the opinion now generally held, that tonsillectomy should not be performed during or shortly after an attack of acute tonsillar disease, is no longer tenable, because this expectant attitude does not always prevent complications. The author thought that complications were usually caused by too radical an operation at the lower pole of the tonsil. That complications did not develop during his tonsillectomies, in spite of the fact that acute inflammations existed, was considered to be the result of his procedure to avoid a complete removal at the lower pole. It was asserted that, provided all the deeper recesses are removed, a tonsillar stump may remain at the lower pole because even radical removal does not prevent the aftergrowth of tonsillar tissue. The author stressed the fact that tonsillectomy not only is permissible during

the existence of a peritonsillar abscess but is the most favorable form of treatment, especially in cases of recurrent abscesses

In a report on electrosurgical extirpation of the tonsils, Silvers described the various methods employed with their end-results. He concluded that the electrothermic technic has a definite place in otolaryngology. He described the advantages and disadvantages of the operative procedure.

Boutarel discussed the indications for and the methods of surgical diathermy. He stated that he preferred the spherical to the needle electrode as being less drastic in its effect and more easily visible. At the same time, he favored a continuous current. Complications are rare and are usually due to coagulation of an aberrant vessel. A secondary hemorrhage may result after loss of the eschar, but with the cautious use of the cautery such accidents can be prevented.

McKenzie expressed the conviction that diathermic coagulation will come to be the method of choice for removing tonsils in adults. It is unsuitable for children.

Schulte enumerated the following conditions in which roentgen treatment of the tonsils is indicated: (1) If anesthesia or operation is contra-indicated, (2) if a secondary hemorrhage is to be feared because of arteriosclerosis, (3) if the tonsils are infected, with the result that an operation might disseminate the bacteria and cause a pulmonary abscess, septicemia or endocarditis, (4) if the regional lymph nodes are infected, (5) if the patient has a chronic cardiac disturbance, diabetes, exophthalmic goiter, chorea, rheumatism, hemophilia, asthma, tuberculosis, status lymphaticus or any disease that greatly lowers the bodily resistance, (6) if the patient has frequent attacks of peritonsillar abscess, (7) if the patient is a singer or a public speaker and has frequent attacks of sore throat and catarrh, and (8) if frequent attacks of sore throat and catarrh occur following tonsillectomy.

During the past three years Schonfeld and Baumbach have treated 150 children, aged from 3 to 13 years, with enlarged tonsils by means of roentgen irradiation. Of 106 of these children who were kept under observation the tonsils returned to their normal size in 41, became much smaller in 19 and remained unchanged in 40. Examination from two to three years after the completion of the treatment showed that in only 43 cases (41 per cent) were the tonsils smaller than they had been before irradiation. In all the patients, however, in whom the size of the tonsils had decreased following the treatment, breathing through the mouth during sleep had ceased, and in the great majority the previously frequent attacks of pharyngitis had disappeared completely. In none of the cases was the treatment followed by chronic injury of the mucosa or a disturbance in the functioning of the glands of the mouth and pharynx. On the basis of their experience in these cases the

authors expressed the belief that roentgen irradiation of enlarged tonsils is indicated particularly in patients with a history of frequently recurring infections of the pharynx

According to Scal the treatment of inoperable tonsils with the implantation of removable platinum radon seeds is an adequate substitute for tonsillectomy in those cases in which surgical intervention is contraindicated. Only one treatment is necessary. There is no hospitalization and no anesthetic, and the patient does not have pain or discomfort in attending to his usual occupation. As compared with roentgen treatment, radium exerts its action only on the lymphoid tissues in the area implanted, without affecting the adjacent tissues. The roentgen rays affect all the tissues and result in annoying after-effects. Electrocoagulation likewise can be used only by skilled hands, even then, there is the possibility of damaging the adjacent structures.

The advantages of suction tonsillectomy described by Waring are as follows. The technic is simple and easily mastered. It is applicable to all types of tonsils and can be used under local or general anesthesia. The operation is performed rapidly, therefore requiring only a short period of time under general anesthesia. The operation is comparatively bloodless, and all infected material from the tonsil is readily removed, thus minimizing the danger of aspiration into the lungs.

The use of the Waring method of suction tonsillectomy was reported by Jacobs and Trauner who reviewed their technic and results in a group of 389 cases. They concluded that tonsillectomy by the suction method is comparatively simple, but the technic must be acquired by practice. The entire tonsil and its capsule are removed without damage to the surrounding tissue or with a minimum of trauma. The operation is usually bloodless, and all infectious material is completely removed by suction so that the danger of postoperative pulmonary abscess or pneumonia is eliminated.

During the past ten years Stout has used the eversion method of tonsillectomy. The tonsil is grasped by a tenaculum forceps and drawn well out of its fossa. The Allis dissector or the Lott evertor is used to tear through the plica covering the lower portion of the tonsil. This allows the tonsil to evert more easily. The evertor is plunged into the upper part of the tonsil and the tonsil is everted. The operator then takes a second grasp including the upper and lower poles. A Lewis snare is applied, the loop is pressed against the pillars and the snare is tightened slowly. Stout and his colleagues have performed more than 15,000 operations by this method.

Bud related his experiences with the closed ethyl chloride and oxygen narcosis method in more than 300 tonsillectomies. He commented on its safety and freedom from postanesthetic complications.

In a study of the end-results of tonsillectomy with special reference to sinus infection in adults, Pond reported on a group of 108 cases. In his opinion the tonsils may become infected from the material which drains from the sinuses into the pharynx. In the group of 108 cases 5 patients were considered as cured. There were 3 cases of ethmoiditis and 2 of sphenoiditis. In 51 cases of various types there was definite improvement, and in 52 cases there was no benefit from tonsillectomy. The basis for cure or improvement of the sinusitis is based on the improvement of the general condition of the patient following tonsillectomy.

A new instrument for the control of tonsillar hemorrhage has been described by Alper. The instrument is composed of two round perforated knobs which end at their proximal extremity in a collar-like ridge containing a rubber ring. Pressure is maintained by a spring arrangement which not only keeps the pressure equal and constant, but which enables the patient to swallow while the instrument is in place.

Shewman described an instrument to control hemorrhage after tonsillectomy, which consists of a special forceps for inserting a skin clip into the tonsillar fossa.

A new tonsil forceps designed by Berger is adaptable to all types of tonsils, and enables one to grasp small tonsillar tags.

A new instrument for grasping tonsil tabs was described by Scal. The grasping end consists of two cuplike blades, which are serrated at their margins and fit accurately into each other.

A sponge-holder for applying pressure in the adenoid area has been devised by Schwartz.

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News and Comment

The Colorado Congress of Ophthalmology and Oto-Laryngology—The ninth annual summer graduate course and the Colorado Congress of Ophthalmology and Oto-Laryngology will be held from July 20 to August 1, inclusive. The class will be divided into small sections for the demonstrations and clinics. Daily complimentary luncheons followed by round table discussions will be continued as a popular feature. The Congress will be held on Friday and Saturday, July 24 and 25, for the presentation and discussion of special papers. At the completion of the program, on the afternoon of July 24, there will be a motor trip into the Rocky Mountains followed by a complimentary banquet at the Mountain Home of the Motor Club of Colorado. Among those who have consented to give special courses this year are Dr C S O'Brien, Iowa City, Dr F H Adler, Philadelphia, Dr H J Howard and Dr French K Hansel, St Louis, Dr A C Furstenberg, Ann Arbor, Mich, and Dr W J McNally, Montreal, Canada. Applications for the graduate course, accompanied by a check for \$50, the total fee, should be sent to Dr H L Whitaker, corresponding secretary-treasurer, 1612 Tremont Place, Denver.

Post-Graduate Course at University of Bordeaux—A post-graduate course in ear, nose and throat surgery will be given by Prof George Portmann in English at the University of Bordeaux, France, beginning July 27, 1931. The class is limited to twelve physicians. Further information may be secured from Dr Leon Felderman, 413 Mitten Building, Philadelphia.

Abstracts from Current Literature

Ear

THE USE OF INSULIN IN POSTOPERATIVE MASTOIDITIS WITH PROLONGED DRAINAGE M S ERSKLER and J J PRESSMAN, Ann Otol Rhin & Laryng 39 1125 (Dec) 1930

Delayed healing of mastoid wounds is frequently encountered in patients whose general condition is below normal, even though there is no reason to believe that cells have been left unopened or that anything but complete evacuation and thorough drainage had been accomplished at the time of operation. Such patients usually have been acutely ill for a long time, they have become anemic, have poor appetites, and have developed a low resistance, all of which has a definite bearing on the progress of the mastoid wound. In order to improve the physical status of the patient, the authors have adopted the use of subcutaneous injections of insulin in cases of delayed healing and prolonged suppuration following mastoidectomy in nondiabetic persons. In a comparatively small series of cases the results have been very satisfactory. Reported observations of many workers has revealed that in malnourished persons the use of insulin increases the appetite and brings about a gain in weight together with an improvement in general well being. Single daily doses of insulin were administered, the patients being instructed to report one-half hour before lunch for the injections. In children the usual initial dose was three units, being rapidly increased to five or more, according to the reaction observed and the ability of the patient to tolerate larger doses. A diet rich in fats rather than carbohydrates is logical, for the appetite created by the use of insulin is soon lost if carbohydrate is taken early in the meal. The treatments were usually started during the sixth or seventh week of convalescence. In each case, in keeping with the improvement in general health and appetite, there followed a rapid decrease in drainage, new granulations appeared, and rapid and complete healing occurred.

SANAP, Grand Rapids, Mich

TREATMENT OF THE DEAF INFANT G DE PARREI, Progres med, Dec 13, 1930, p 2208

The author classifies deaf infants in three groups: deaf-mutes, partially deaf children and those hard of hearing. The deaf-mutes should be given over to educational specialists at 3 years of age. The partially deaf infants frequently show rhinolaryngologic defects and should be examined thoroughly, after which special education is indicated. The children who are hard of hearing should be in special classes of not over eight or ten pupils.

SANFORD, Chicago

CLINICAL ASPECTS OF INFLAMMATORY DISEASES OF APEX OF PETROUS PORTION OF THE TEMPORAL BONE E GRABSCHIED, Monatschr f Ohrenh 65 289 (March) 1931

Grabschied states that the inflammatory diseases of the apex of the petrous portion of the temporal bone have received more attention in recent years. It was found that the symptoms on the part of the abducens, which were formerly considered characteristic, were less frequent than the symptoms from the trigeminus. In regard to the anatomic foundations of the diseases of the apex of the petrous part, opinions are still divided. Some observers consider extradural or osteitic foci the cause, whereas others assume a local meningitis. Recent investigations by Brummer have proved that in the majority of cases a serous meningitis is the cause. The author describes two cases. In both patients there existed an acute otitis together with a completely developed mastoiditis, and following the opera-

tion serous meningitis developed. As sign of the serous meningitis, there existed in the first case a sensitiveness to pressure and to percussion in the malar process, also dermographism, stiffness of the neck, high temperature, Kernig's sign, slight stupor, positive Nonne-Apelt reaction and postoperative increase in temperature. In the second case there were high temperatures, dermographism and positive Nonne-Apelt and Pandy reactions in the cerebrospinal fluid. The clinical manifestations of serous meningitis are not characteristic. However, the term serous meningitis is significant for differentiation from the suppurative form, and there is nearly always a complete recovery after serous meningitis. The two patients observed by the author also recovered. The increased pressure of the cerebrospinal fluid, which some consider as a significant symptom of serous meningitis, the author considers of minor importance, because it is influenced by too many factors, so that it is difficult to interpret slight fluctuations. However, he attaches greater importance to an increase of the albumin and of the globulin. Of the symptoms indicating an irritation of the trigeminus, which are frequently manifest in diseases of the apex of the petrous portion of the temporal bone, the author mentions pains in the temple and in the depth of the orbit, pounding pain in the depth of the ear and toothache. However, the most characteristic symptom of a meningitis localized on the apex of the petrous part is the hyporeflexia of the cornea on the side of the diseased ear.

EDITOR'S ABSTRACT

PATHOGENESIS AND CLINICAL ASPECTS OF TRAUMATIC INJURIES OF THE INTERNAL EAR. M. GOERKE, *Ztschr. f. Rhin., Laryng. (teil 1. Folia otolaryng.)* 20 363 (March) 1931.

Goerke differentiates between direct and indirect injuries of the internal ear according to the manner of attack of the force which causes the trauma. Aside from gunshot injuries during the war, direct injuries of the internal ear are rare. Of the indirect injuries those that occur in fractures of the base of the skull are discussed first. Especially dangerous for the internal ear are transverse fractures. The peculiar brittleness of the petrous portion of the temporal bone is the cause of the development of small fissures in the labyrinth even when the line of fracture does not involve the aural region. Recent observations have proved that such fissures are much more frequent than is generally believed. However, in many cases they are so small that only microscopic examination will reveal them. These fissures may sometimes be the starting point of a late meningitis. The interval between the formation of the fissures and the manifestation of the meningitis may be of considerable length (the longest interval known is 210 days). In cases of otogenetic meningitis, in which the anamnesis reveals a cranial trauma even several months before the meningitis, a causal relationship cannot be denied. Fissures may also cause an ossifying periostitis, which may lead to an obliteration of the labyrinthine spaces and to increasing deafness. Another group of lesions of the internal ear are those designated as commotio labyrinthi, they are caused by a dull blow on the head or by a fall. In these cases the relation between the trauma and the injury of the internal ear is more difficult to recognize than in the traumas previously mentioned. In regard to the nature of the changes in commotio labyrinthi, it is stated that the former theories, which assumed intralabyrinthine hemorrhages, distortions, misplacements and tearing of the soft parts of the labyrinth, have been largely disproved and that more recent investigations have revealed that the changes in commotio labyrinthi are, on the one hand, vascular changes such as marked distention of the vessels, diapedesis of the leukocytes and their perivascular accumulation and, on the other hand, pronounced degenerative changes in the cells of the nuclei of the acoustic nerve. The author further discusses labyrinthine lesions, in which although the cranium is not directly affected by the trauma, the influence on the auditory organ cannot be denied. In the majority of these cases the injury of the internal ear is produced by less severe but by continuously acting influences. Nevertheless, there are also cases on record in which one single loud tone or noise has caused an auditory disturbance.

Investigations have revealed that the injuries caused by impacts of air are due to changes in the nervous apparatus, but opinions still differ as to how these changes develop. Some observations revealed that if the physiologic conduction of sound was interrupted, injuries in the internal ear did not develop. This would justify closure of the ears with cotton or wax in workers obliged to work in noisy surroundings. However, others observed that among soldiers who operated heavy artillery guns, and who had closed their ears with cotton, auditory disturbances were more frequent than among those who had not taken these protective measures. The author thinks that a blast may reach the ear by three routes: the aerotympanic, the osteotympanic and the ossal. If the influence is only acoustic the physiologic route is taken, however, in case of a concussion the ossal route is used. The author thinks that the fact that some ears are injured by noise more easily than are others is due to the condition of the ear. A diseased ear is more likely to be injured by noise than a healthy ear, and it is also probable that constitutional factors create a predisposition. Of course, even healthy ears may be injured by continued noises, but the changes that develop are generally reversible, provided that periods of rest are introduced which make it possible for the ear to recover from the strain.

EDITOR'S ABSTRACT

ROENTGEN DIAGNOSIS IN MASTOIDITIS. K. SCHEUER, *Ztschr f Laryng, Rhin* (teil 1 *Folia oto-laryng*) **20** 437 (March) 1931

According to Scheuer, roentgenoscopy of the mastoid process is still new. He therefore considers it advisable that experiences should be reported and errors pointed out. As yet the roentgen method is imperfect, so that it can be only an auxiliary method. Correct interpretation of the roentgenograms is especially difficult. After describing the technic of roentgenoscopy that is employed in the university clinic in Wurzburg, the author compares the results of roentgenoscopy with the operative findings in 104 cases of mastoiditis. He found that the roentgenogram had been interpreted correctly in 78 and incorrectly in 25 cases. In the incorrectly diagnosed cases, in 11 in which the roentgenograms were negative the operative findings were positive and in 14 in which the roentgenograms were positive the operative findings were negative. These statistics show that the roentgenogram may simulate disintegrating processes that in reality do not exist. In analyzing these cases it was found that the causative factor in most incorrect diagnoses is the sinus canal. Deception is produced by the fact that the sinus canal becomes visible in a certain circumscribed portion, the lessened density may be interpreted as indicative of a disintegrated area. The sinus always becomes visible when the air content of the cells covering it has decreased to such an extent that its shadow is no longer covered. The decreased air content may be caused by the following conditions: 1. The air in the cells may have been displaced by exudate. 2. The sinus may no longer be covered by cells, (many operations have corroborated this) so that the conditions are the same as in a compact mastoid process. In the latter condition likewise the sinus becomes visible, the air-containing cells which cover its shadow are absent. In all except four of these cases there were mastoid processes with inhibited pneumatization, so that the roentgen pictures, even when the operative results were known, gave no sure indications of changes in the bone. In such mastoid processes the stereoscopic method of exposure has been found helpful. The results of this method will be reported later after a sufficiently large amount of material has been studied.

EDITOR'S ABSTRACT

HISTOLOGIC OBSERVATIONS ON FENESTRAE IN ACQUIRED DEAFNESS AND COMMENT ON HEALING OF SURGICAL INJURY OF THE STAPES. H. BRUNNER, *Ztschr f Hals-, Nasen- u Ohrenh* **28** 79 (March 3) 1931

Brunner reports the case of a woman, aged 25. After a short report of the clinical history, he gives a detailed description of the results of necropsy. This

case is significant because it shows (1) the changes in the internal ear in deafness following meningitis, (2) the changes in the mucous membrane of the middle ear many years after a radical operation and (3) the microscopic picture of the operative injury of the stapes with its sequelae. The results of the microscopic examination of the right temporal bone are summed up as follows: (1) suppurative infiltration of the mucous membrane of the tube and of the middle ear, (2) penetration of the cylindric epithelium into the upper wall of the external auditory meatus and of the epidermis into the middle ear, (3) a healed osteitic focus in the upper wall of the bony auditory meatus, (4) luxation of the stapes against the middle ear, (5) partial closure of the fenestra ovalis by a membrane of connective tissue, (6) a healed osteitic focus on the upper and the lower frame of the fenestra ovalis, (7) obliteration of the fenestra rotunda by connective tissue, (8) a connective tissue canal in the lamina spiralis ossea secundaria, (9) partial ectasis and partial collapse of the membranous canal of the cochlea, (10) connective tissue strands in the scala tympani, (11) atrophy of the organ of Corti, (12) marked atrophy of the nerve ganglion apparatus of the cochlea, (13) a vestibulocochlear septum, and (14) dilatation of the ductus endolymphaticus. The following conditions were found on the left side: (1) suppurative infiltration of the mucous membrane of the tube and of the middle ear, (2) a bony canal above the fenestra ovalis, (3) luxation of the stapes against the middle ear, (4) a fissure of the base of the stapes, (5) a bony canal underneath the fenestra rotunda, (6) atrophy of the spiral nerve and the spiral ganglion, (7) atrophy of the trunk of the cochlear nerve, (8) a vestibulocochlear septum, (9) dilatation of the endolymphatic and utriculosaccular ducts, (10) adhesions between the base of the stapes and the free wall of the utricle, and (11) an increased number of the cartilage-containing, interglobular spaces.

EDITOR'S ABSTRACT

METHOD TO PROVE ABSENCE OF OBTURATING SINUS THROMBOSIS OR JUGULARIS THROMBOSIS IN A CASE IN WHICH THERE WAS A PYEMIC FEVER CURVE
O MUCK, *Ztschr f Hals-, Nasen- u Ohrenh* **28** 98 (March 3) 1931

Muck points out that it is sometimes difficult to decide whether an obturating thrombosis exists in the sinus transversus or in the sinus jugularis. In doubtful cases in which it is difficult to decide whether the sinus should be opened or the jugularis should be ligated, he employs a special diagnostic method. As compression of the jugular vein of one side produces a venous murmur on the other side or intensifies the already existing murmur, especially in children, the author employed this method when a pyemic fever curve existed in the course of an acute purulent otitis media. The positive outcome of this test indicates that an obturating thrombosis does not exist. The author stresses the fact that in order to avoid unnecessary and dangerous operations on the sinus, this method should be employed only in doubtful cases. However, if sinus phlebitis is evident, this differential diagnostic aid should be omitted, and the necessary therapeutic measures should be carried out as soon as possible.

EDITOR'S ABSTRACT

THE SEDIMENTATION OF ERYTHROCYTES IN INFECTIONS OF THE MIDDLE EAR
V HLAVÁČEK, *Časop lek česk* **67** 1395 (Oct 5) 1928

Cases of mastoiditis showed increased sedimentation of red cells independent of temperature. Extensive lesions were found in all cases of accelerated sedimentation. The figures for increased sedimentation were comparable with those for extensive pathologic processes, such as tuberculosis, with marked elevation of temperature. Practically only the decreased sedimentation time is of value with other signs and symptoms in deciding as to operation. In cases of decreased sedimentation no tissue detritus except nonpurulent cholesteatoma was noted.

STULIK, Chicago

STATISTICAL REPORT ON THE CAUSE OF DEAF-MUTISM IN THE VYMOLA INSTITUTE IN PRAGUE VYMOLA, Časopis česk 67 1525 (Nov 2) 1928

In 112 patients, the diagnosis on objective indications was congenital deaf-mutism in 71, acquired deaf-mutism in 37 and deaf-mutism of undetermined origin in 4. On careful checking of the family history it was found that the condition was truly congenital in only 53. The reasons cited for acquired deaf-mutism were undetermined fever, 2 cases, pertussis, 1 case, grip, 2 cases, meningitis, 1 case, otitis media, 1 case, measles, 1 case, convulsions, 3 cases, trauma (fall), 4 cases, fright, 2 cases, and difficult teething, 1 case. The causes given in the series cited are consanguinity, mendelian heredity, mongolism, constitutional diseases, alcoholism, infectious diseases and social environment.

STUBIK, Chicago

Pharynx

OPERATIVE PROCEDURE FOR MAKING PASSABLE THE CICATRICALY OCCLUDED NASOPHARYNX Z WEIN, Monatschr f Ohrenh 65 352 (March) 1931

Wein discusses that group of obstacles to nasal breathing that are caused partly by cicatricial occlusion of the portion of the nasopharynx that is posterior to the choanae (retronasal synechias and atresias) and partly by cicatricial adhesions of the soft palate to the posterior wall of the pharynx (palatopharyngeal synechias). As causes of these conditions, he mentions syphilis, leprosy, lupus, diphtheria and faulty technic in tonsillectomy. In discussing the disadvantages of these occlusions, he points out that the hindrance to nasal respiration has a detrimental influence on the respiratory passages, on the elasticity of the lungs and on the circulation. The stasis of the nasal secretion is not only unpleasant but it also leads to catarrh of the nasal cavity and frequently to sinusitis. The sense of smell is entirely absent, the taste is dulled, and the absence of nasal breathing has also a detrimental effect on the auditory organ. The author further reviews the various methods that have been employed for the treatment of the occluded nasopharynx, and then describes his own operative procedure which he used on a woman, aged 50. Following cocaineization of the nasal and of the pharyngo-oral cavities, he anesthetizes the outer part of the nose, the nasal septum and the cicatricial tissues in the nasopharynx by injecting a 1 per cent solution of procaine hydrochloride. He then makes the incisions according to Schloffer's method so that the outer portion of the nose can be entirely turned aside. Following bilateral separation of the mucous membrane from the nasal septum, he performs a submucous resection of the portion of the septum that is in the nasal cavity proper. The cartilage and the bone of the septum is removed to such an extent that on the base of the skull as well as on the base of the nose there remain only ridges of bone from 2 to 3 mm high. Then the cicatricial tissues are removed, and following this, the soft palate is lifted from the posterior wall of the pharynx. Two pedicle flaps, obtained from the mucous membrane coverings of the nasal septum, are used to cover the surfaces of the wound. The mucous membrane grafts are fixed by means of an iodoform gauze tamponade, which is left in place for one week. The author further describes the after-treatment for the purpose of dilatation, and the results of this surgical treatment. There is no longer stasis of the nasal secretion. The nasal respiration is sufficient, the sense of smell gradually returns, the pharynx is no longer dry, and the soft palate has almost entirely regained its elasticity. The patient feels much better than before the operation. The author thinks that in severe cases of retronasal and palatopharyngeal adhesions his method brings better results than those formerly employed. Of course, Schloffer's method, which permits a turning aside of the outer portion of the nose, is advisable only in cases in which there are extensive adhesions. However, the resulting cosmetic defect is of minor significance when it is considered that such an operation is generally necessary in persons in whom the nose is already deformed.

EDITOR'S ABSTRACT

ANGINA AGRANULOCYTOTICA BAYER, *Ztschr f Laryng, Rhin (teil 1 Folia oto-laryng)* 20 375 (March) 1931

Bayer reports the clinical history of a woman aged 51. Following extraction of several suppurating roots of teeth she was troubled with severe pains in the gums and with headaches. Later she had chills, sore throat, headaches and slight fever. The physician in charge diagnosed the case as tonsillitis. Shortly after that the patient again had fever and inflammation of the throat and the tongue. A peritonsillar abscess was discovered and was incised. Later, necrotic processes developed on various portions of the oral mucous membrane and on the genitalia. The blood picture revealed the characteristics of agranulocytosis, and treatment with arsphenamine was then resorted to. The patient was given an intravenous injection of 0.45 Gm of neoarsphenamine and simultaneously an intramuscular injection of 0.3 Gm of myoarsphenamine. The effect of this large dose of arsphenamine was surprising. The patient no longer had difficulty in swallowing, the necrotic processes healed gradually and the blood picture improved. In a comparatively short time the patient recovered completely and was discharged from the hospital. Six months later, however, the patient had a relapse, and this time neoarsphenamine was without effect. The patient died. In conclusion it is pointed out that it is not entirely new to employ arsphenamine in cases of this type, but that in the majority of cases it fails, probably because of insufficient doses. The good results in the reported case are ascribed to the large dose, and the author advises that in such cases the maximum doses should be given at the first administration in order to overcome the organism's biologic lethargy.

EDITOR'S ABSTRACT

ARREST OF HEMORRHAGE AFTER TONSILLECTOMY A REPLY TO AN ARTICLE BY GUMPERZ E. KRONENBERG, *Ztschr f Laryng, Rhin (teil 1 oto-laryng)* 20 458 (March) 1931

Kronenberg replies to an article by Gumperz, in which the latter emphasized the necessity of the complete removal of the tonsil and the ligation of all vessels. Kronenberg shows that Gumperz' emphasis on these points is superfluous, since these principles are known and adhered to by every competent surgeon. Kronenberg also takes exception to Gumperz' statements that chemical hemostatics may be employed to produce escharotic effects, and that they may be used as substitutes for the careful ligation of the vessels.

EDITOR'S ABSTRACT

Nose

CORK AS PLASTIC MATERIAL FOR THE CORRECTION OF SADDLE NOSES H. DAHMANN, *Ztschr f Laryng, Rhin (teil 1 Folia oto-laryng)* 20 451 (March) 1931

Dahmann first gives a general review of the various plastic methods. He discusses (1) transplantation of flaps of skin and connective tissue and (2) subcutaneous implantation of supporting materials. In regard to the first method he says that the cosmetic results are rarely satisfactory. In discussing subcutaneous implantation he first evaluates autoplasmic materials, such as rib cartilage, iliac crest or a piece of the tibia. Preparatory to evaluating the various alloplastic materials he points out that alloplasty is contraindicated whenever extended cicatricial adhesions exist between the skin of the nasal bridge and the underlying bone. In such cases the skin, when lifted, is too thin and does not contain a sufficient number of vessels to guarantee adequate nutrition. In these cases living tissues, that is, autoplasmic materials are required that form organic connections. Of the various alloplastic materials the author mentions paraffin, ivory and cork. The use of paraffin has been almost completely abandoned on account of its many disadvantages. Ivory, as plastic material, brings more favorable results than

paraffin, nevertheless, it also has certain disadvantages. A slight blow on the nose causes intense pain or may lead to the development of a hematoma, the resorption of which is extremely slow. Another disadvantage is the heavy feeling and the sensation of coldness during the cold season. The use of cork as plastic material has many advantages. It is resistant and is not subject to resorption. At any rate, if there is resorption it must be slight, for in patients in whom the cork was implanted more than four years ago, the condition is not yet changed. Other advantages of cork are that it is soft, elastic, light and a poor conductor of heat. In describing the technic the author emphasizes the advisability of selecting cork that has only a few pores and not too many stone cells. The preparation of the cork for the implantation requires five days. At first the piece of cork is cut comparatively large. It is boiled for one hour and then dried. On the following day it is cut a little smaller and boiled and dried again. On the third day it is subjected to the same process. On the fourth day it is given the shape required for the implantation, boiled again, then placed (from five to ten minutes) into a boiling solution of potassium permanganate (1:1,000), rinsed in boiling water, discolored in a hot 5 per cent solution of sodium bisulphite, washed again in boiling water and then dried. On the fifth day, the day of the operation, the implant is boiled for ten minutes, placed in a physiologic solution of sodium chloride and then implanted. The incision for the implantation is made in the groove above the left ala nasi. The pocket, which is to receive the implant, should be large enough so that the cork can be introduced without creating tension.

EDITOR'S ABSTRACT

Miscellaneous

PRACTICAL SIGNIFICANCE OF CORRECT POSITION OF PATIENT IN OTOSURGICAL INTERVENTIONS IN ORDER TO AVOID SECONDARY INJURIES. G. ALEXANDER, *Monatschr f Ohrenh* 65 277 (March) 1931

Alexander points out that in otosurgical interventions the correct position of the patient, that is, the topographic adjustment of the head, is of vital importance. The approach to the otosurgical regions is always from the antrum. The antrotomy is the technical foundation of even the most remote otosurgical interventions on the brain. The otosurgical exposure follows rules that are based on the topographic arrangement of the different parts. These geometric relations are guilty only when the head is in a certain position. A slight change in the position of the head causes considerable changes in the topography of the surgical field so that such terms as vertical, to the front, upward and backward can no longer be followed. It is therefore essential that before the surgeon commences to operate he sees that the patient's head is in the proper position. Of the surgical interventions in which the position of the head is of vital importance, the author mentions particularly paracentesis, antrotomy, removal of the mastoid process without exposure of sinus or dura and exclusion of the jugularis. He shows what complications may arise if the head is not in the correct position and gives diagrams showing the correct and the incorrect positions.

EDITOR'S ABSTRACT

Society Transactions

AMERICAN SOCIETY FOR THE STUDY OF DISORDERS OF SPEECH

ROBERT WEST, PH D, *Editor*

Chicago, Dec 30 and 31, 1930, and Jan 1, 1931

ELMER L KENYON, M D, *Chairman*

A SYMPOSIUM ON STUTTERING (STAMMERING)

- THE PHENOMENOLOGY OF STUTTERING DR ROBERT WEST, Madison, Wis
- THE EDUCATIONAL APPROACH TO THE PROBLEM OF STUTTERING DR H J
HELTMAN, Syracuse, N Y
- CAN CLINICAL PROCEDURE IN THE TREATMENT FOR STUTTERING BE USED IN
THE PUBLIC SCHOOLS? MISS PAULINE B CAMP, Madison, Wis
- HOW DR G HUDSON MAGUEN TREATED STAMMERING MISS MARY SUMMERS
STEEL, Philadelphia
- STAMMERING AS AN IMPEDIMENT DR C S BIUEMEL, Denver
- CORRECTION OF STAMMERING IN BIG SCHOOL SYSTEMS MISS LETITIA
RAUBICHECK, New York
- BASIS FOR WORK WITH STUTTERERS IN GRAND RAPIDS PUBLIC SCHOOLS MISS
EUDORA P ESTABROOK, Grand Rapids, Mich
- TWELVE YEARS OF VISUAL TREATMENT FOR STUTTERING MISS M CLAUDIA
WILLIAMS, Cleveland
- METHODS USED IN THE TREATMENT OF THE STUTTERING CHILD IN THE PUBLIC
SCHOOLS OF OMAHA (NEBRASKA) MISS ALICE LILJEGREN, Omaha
- RELATIONSHIP OF PERSONALITY AND BEHAVIOR DIFFICULTIES TO DISORDERS
OF SPEECH DR PAUL L SCHROEDER and MR LUTON ACKERSON, Chicago
- BREATH CONTROL IN STAMMERING MR SAMUEL D ROBBINS, Boston
- DUNLAP'S THEORY OF THE TREATMENT FOR STUTTERING DR JOHN M
FLETCHER, New Orleans
- STUTTERING DR SMILEY BLANTON, Poughkeepsie, N Y
- A CONSIDERATION OF SOME OF THE PSYCHOLOGIC CAUSES AND TREATMENT
OF STAMMERING MRS MABEL FARRINGTON GIFFORD, San Francisco
- WHY VISUALIZATION IS THE BEST METHOD FOR STAMMERING DR WALTER
B SWIFT, Boston
- THE CORRECTION OF STAMMERING IN DETROIT MISS CLARA B STODDARD,
Detroit
- THE TREATMENT FOR STUTTERING IN THE PUBLIC SCHOOLS OF WISCONSIN
MISS LAVILLA A WARD, Madison, Wis
- SOME INTERPRETATIONS OF RECENT RESEARCHES IN THE CORRECTION OF
STAMMERING DR ELIZABETH A McDOWELL, New York
- THE READJUSTMENT OF THE STUTTERER'S SPEECH MISS JENNIE HEDRICK,
Washington, D C
- DIAGNOSIS AND TREATMENT IN CASES OF STUTTERING DR LEE EDWARD
TRAVIS, Iowa City

- ORAL STAMMERING. ONE OF THE MANIFESTATIONS OF THE CONFLICTS OF THE ORGANIC STAMMLER. DR CHARLES G STIVERS, Los Angeles
- SPEECH TRAINING AND MENTAL HYGIENE METHOD FOR THE CORRECTION OF STAMMERING. MISS MILDRED A MCGINNIS, St Louis
- THE PROBLEM OF STUTTERING. MR FREDERICK W BROWN, New York
- THE NATURE AND ANALYTICAL TREATMENT OF STAMMERING. DR ISADOR H CORIAT, Boston
- TREATMENT FOR STUTTERING. MR BRYING BRYANLISON, Minneapolis
- STUTTERING. WHAT ABOUT IT? DR JAMES SONNITT GREEN, New York
- CONSCIOUS DETAILLED PSYCHOMUSCULAR CONTROL OF SPEECH PRODUCTION AS AN EFFECTIVE (IF NOT NECESSARY) BASIS FOR ALL MANNER OF PSYCHOLOGIC TREATMENT FOR STAMMERING. DR ELMER L KINYON, Chicago
- NEUROPEDAGOGICAL PROCESS OF TREATING STAMMLERS AND STUTTERS AT OHIO STATE UNIVERSITY. DR G OSCAR RUSSELL, Columbus, O

Although limitation of space prevents a detailed abstracting of these papers certain interesting observations can be made on the program as a whole. A mere statement of the positions assumed by various speakers on a few of the outstanding points of difference will reveal the theories held by these authorities perhaps better than lengthy quotation from their papers.

IS STUTTERING A NEUROTIC OR PSYCHONEUROTIC MANIFESTATION

For

DR SMILEY BLANTON, Poughkeepsie, N Y. Stuttering is a symptom of the inability of a child to adjust himself to the group. It is caused by fear, timidity or a negative (hate) attitude toward the group. The child wishes to talk with his conscious mind, but with the unconscious mind there is an inhibition against speech. Stuttering is the result.

Psychoanalysis has made a valuable contribution to the cause and treatment of stuttering. The first stage of the love life of the child is the oral erotic stage in which the child not only uses the mouth to get nourishment, but also to get sexual pleasure of the infantile type. The region of the mouth is highly charged with emotion, and sounds are made partly because of the pleasure they give through the stimulation of the vocal organs. This oral erotic stage passes normally. Sometimes, however, the child remains fixed in this stage, his love energy is centered on himself, and he becomes narcissistic. It is this narcissism that gives rise to timidity and self-consciousness.

DR ISADOR H CORIAT, Boston. Stammering becomes a neurosis in which the fixation of the libido at the developmental stage of oral erotism persists into maturity. In his unconscious, and likewise in the conscious, motor speech reactions, the stammerer remains fixed or anchored to this primitive biologic stage because he has been unable to sublimate, or has been able to sublimate only to a very limited degree, the original oral pleasure.

MR SAMUEL D ROBBINS, Boston. I regard stammering primarily as a mental ailment, varying in intensity with the degree of the emotion the stammerer happens to be experiencing.

MRS MABEL FARRINGTON GIFFORD, San Francisco. It must be fully understood in the beginning that according to my theory the causes of these nervous disorders of speech are psychologic, and that the spasmodic manifestation of the speech organs is only the external symptom of the deepseated mental conflict. It has now been definitely established that severe shocks and emotional conflicts in very early childhood remain as subconscious memories for many years and may continue to disturb the function of speech, which in itself is perfect, until corrective measures are applied. One can understand more easily the relation between stuttering and the subconscious emotional memories and conflicts when one considers that every normal speech reflects the momentary emotional state of mind.

DR CHARLES G STIVERS, Los Angeles Stammering, in common usage, is recognized as an oral manifestation of emotional instability Verbal stammering, however, is but one manifestation of the deeper and broader emotional maladjustment that finds an outlet in deviation from a normal or organic rhythm of life

MR FREDERICK W BROWN, New York The cause of this maladjustment is, I believe, emotional, and stuttering is but a symptom of the lack of integration of the personality of the stuttee

DR JAMES SONNETT GREENE, New York Just how to apportion heredity and environment as etiologic factors in stuttering is about as contentious as in any other field From all indications, stuttering is primarily psychologic rather than biologic By it being psychologic, I mean that the stuttee is influenced by factors of training — the likes and dislikes the bents, slants and attitudes, the character that one as an individual brings to one's daily actions and associations The stuttee cannot directly inherit stuttering speech, but without doubt he inherits his neuropathic constitution, and if he lives in tense surroundings, almost any disturbance is liable to start the stuttering Most histories in cases of stuttering show nervous traits in the patient, in the parents and in other members of the family

Against

DR LEE EDWARD TRAVIS, Iowa City It is my opinion that few stutters need a searching psychoanalysis any more than most so-called normal persons I am not aware of any experimental or clinical evidence that stuttering is a manifestation of an anxiety neurosis or anxiety hysteria If the stuttee presents a morbid anxiety, it is mainly an effect and not a primary cause As I have repeatedly maintained, the anxiety and fears of the stuttee are reactions to, and are developed after, the appearance of his defect

MR BRYNG BRYNGELSON, Minneapolis Before discussing the major aspects of the treatment of the 127 cases reported at the close of the paper, I should like to point out that the success of the dominance technic is so marked that I have come to feel that a differential diagnosis, in which other causation factors in regard to treatment are usually considered, though valuable, is not essential Oral erotic symptoms, lack of visual imagery, consonant or vowel interference, psychoneurotic trends or a dozen other factors around which different treatments have been built need not be considered as such in cases in which stuttering is definitely traceable to a shift from left-sided to right-sided cerebral dominance I am suggesting the possibility that no matter how a stuttee stutters, nor for what etiologic reason, he can be treated effectively by the method based on the theory of cerebral dominance

MISS MILDRED A MCGINNIS, St Louis It was with a feeling of pleasure that I read the abstracts of the papers contributed to this program and found that the true psychoanalysts were absent and even such tendencies were in the minority I have not the opposite opinion that behavior analysis has no place in the therapy for the relief of stuttering, but I do believe that the erudite premises and conclusions of a number of such theorists have been a greater pleasure to their student minds than a help in affecting a desired result

DR G HUDSON MAKUEN (quoted) That many stammerers are profoundly neurotic must be admitted, but the question is as to what extent their neurotic condition is the cause of the stammering and its continuance, and to what extent it is the result of the affection That it is more largely resultant than causative at least in the chronic cases, is a conclusion that has been reached after a careful study of this subject, and the only way to rid the stammerer of his nervousness is to prove to him that he can overcome his stammering The treatment of the affection therefore, must be approached through the physical, rather than through the psychical condition of the patient, because the one dominating and overpowering idea is that of his inability to conquer his defect

DR C S BLUEMEL, Denver Emotion has long been suspected in connection with stammering It was first thought of in simple terms such as embarrassment

and self-consciousness. Later the study became detailed, and the stammerer's sublimations were said to have gone awry. Let us meet this contention by assuming that our psychoanalytic friends are right, and that the problem is one of conflicts and psychic traumas. Then the question arises, Why stammering? Why does not the patient develop facial tic, torticollis, cardiospasm or astasia-abasia? If we admit that emotion accounts for the presence of the nervous disturbance, then we must look for something that determines the character of the disturbance. In the case of stammering, we must go beyond the emotion and investigate the verbal thought. These facts seem to point away from emotion and in the direction of mental speech.

Conditional

DR PAUL L. SCHROEDLER, Chicago. While these statistical calculations indicate the type of psychoneurotic, unaggressive behavior generally associated with stammering, they do not of themselves tell which is primary and which is secondary. It may be that stammering is a symptom of this type of personality defect or it may be that this type of personality is the result of the child's reaction toward his stammering. Or it is possible that the stammering and the personality of the stammerer are both symptoms or concomitants of some deeper-lying causal complexes which will require more intensive research to isolate and identify.

DR ELMER L. KLEIN, Chicago. I grant freely that the muscular disturbance is dependent to an important degree on emotional excitement at the moment of the production of speech. When the disordered, muscular phenomena are not dependent on emotional excitement, they are then dependent on either psychomuscular habit or on intentional production by the stammerer of muscular wrongness of action. But I do grant that the nervous phenomena as manifested cannot be dissociated from the muscular phenomena any more than the muscular phenomena can be dissociated from the nervous phenomena. In other words, as the muscular disturbance is dependent on the emotional excitement, so also are the emotional manifestations just as definitely dependent on the peculiarly disturbing action of the speech mechanism on the mind of the stammerer.

THE RÔLE OF SINISTRAITY AND AMBIDENTRITY AS A CAUSATIVE FACTOR IN STUTTERING

For

Dr. Travis was the most earnest advocate of the "left-handed" causation. He was supported by his disciple Mr. Bryngelson, by Miss Liljegren and Dr. Stivers, and by incidental references to the subject by Dr. Blanton. Miss Liljegren, one of the disciples of Dr. Swift, famous for his theory of visual imagery, includes in her list of probable causes of stuttering among her own pupil-patients a "change from left-handedness to right-handedness."

DR CHARLES G. STIVERS. The brain center governing speech, which is expressed by the lips, tongue, cheeks, larynx, etc., merges with the centers governing the leg and arm and hand. Changing neural dominance of handedness from the left to the right side of the brain therefore affects the centers for speech and for the leg, and confusion, often followed by stammering, results from interference with the native pattern.

DR LEE EDWARD TRAVIS. As we have discovered from the study of cases, a stutterer's present motor leads may be out of harmony with determined native physiologic preferences. Since in many cases the stuttering dates from the beginning of such a discrepancy and disappears with the removal of it, we are led to consider in every case the possibility of changing or reverting in motor leads to the seemingly nonpreferred hand. When it is decided that a "right-handed" stutterer should become left-handed, it is necessary that he make the change as complete as possible. Every manual activity in which a lead from one side of the body is possible should be controlled from the left side. Such would include writing, throwing, cutting, eating, dressing, handling a tennis racket, etc.

Against

MISS MILDRED A MCGINNIS I believe that only when a shift of handedness has been tried out to a 90 per cent satisfactory result will theories of its effects on stammerers be justified By a satisfactory result I mean a correction of at least several years duration In my experience I have found few stammerers to be or to have been left-handed, while there are many people who have been retrained to use the right hand with no ill effects This year we have had two left-handed patients with oral inactivity whose articulation and behavior were in such a state that no harm could be done by experiment While both of these persons are now using the right hands with facility improvement in their speech is no more or less rapid than others who have been trained without attention to handedness

MR FREDERICK W BROWN Wendell Johnson's 'Because I Stutter' with its introduction by Dr Travis forms an interesting and valuable document I cannot agree, however, with Johnson's statement apparently supported by Dr Travis, that "a thorough psychoanalytic investigation of his life showed quite conclusively that there were no psychopathic or mental or nervous causes underlying the defect nor with his conclusion that as soon as I have succeeded in shifting completely to left-handedness I shall talk without stuttering" Why may not the psychoanalytic treatment as well as, or instead of the training in left-handedness have been responsible for his improvement to date and why may not the gradual reintegration of his personality and his readjustment to society, resulting from his psychoanalysis, be responsible for any future improvement in his speech? Again it has not been shown that the training in handedness or other methods employed to establish the dominance of one side of the cerebral cortex are the sole or even the predominant causes of the improvement already made In fact Johnson's narrative furnishes abundant evidence that such factors as the continually reiterated positive suggestions of his instructor, the instructor-pupil relationship and the physician-patient relationship and the restoration of or increase in self-confidence and insight may have been responsible for much, if not all, of the improvement shown

THE VALUE OF SPEECH DRILLS

For

DR ELMER L KENYON The bases of my own conception of the treatment of stammerers go back to G Hudson Makuen and Herman Gutzmann but especially to Makuen Dr Makuen taught conscious active control of the chest coupled with consciously directed production of each elemental sound of speech

DR J HUDSON MAKUEN (quoted) Stammering in the great majority of instances is due primarily to faulty or delayed phonation, or to a lack of promptitude in the vocal mechanism Voice culture therefore should be the keynote of all methods of treatment The first essential of speech production is adequate voice production The restoration of good speech consists largely in the development of a more vivid and distinct auditory imagery for speech sounds

MISS MILDRED A MCGINNIS Speech drills must not be drills in name only They should be component parts of words, such as syllables composed of consonants and vowels for the purpose of establishing a good voice the habit of making the correct coordinations for all consonants and the habit of taking time to give each syllable its value When syllable drills can be given with such requirements there should be an immediate correlation with speech and conversation relative to mental hygiene should be carried on in a new and better voice In detail speech drills would include attention to vowel quality in words, articulation of final consonants and attention to pauses, as the case requires

DR CHARLES G STIVERS Whispering soft tone inflection normal tone and loud voice are all used in their places I put great stress on inflection and show by the effect of my voice on my dog that it is the inflection that attracts or repels

Conscious articulation with the making of large molds or positions for the various sounds, is of importance. I use here a form of massage to loosen the muscles of the lips and cheeks, which are often very tense. I have never put my fingers into the mouth, but sometimes I place a wooden applicator on the spot where the sound is made.

MISS CLARA B. STODDARD, Detroit. The Reeds, whose methods I use, taught phonetics to lead the pupil out of his old ways of attacking speech, and to introduce him to new methods that should eliminate hypertonicity, juxtaposition of the organs of speech and the attempt to produce two sounds at the same time. They built up stronger verbal and visual images of consonant and vowel sounds, training through tactual, auditory, visual and association areas.

DR. ELIZABETH A. McDOWELL, New York. The third step is a more or less hit-or-miss scheme for experimenting on his own part with exercises and schemes for gaining success in acquiring the desired speech reaction. These must be very simple at first. We arranged them into a hierarchy of stimuli or speech exercises according to their frequencies of success. One exercise that is universally successful is speaking isolated syllables in unison with the instructor who is employing an easy, well-modulated voice.

DR. LEE EDWARD TRAVIS. The third period consists of speaking and copying at the same time. The individual begins to write each word before he speaks it thus having the writing movements precede each spoken word.

MR. BRYNG BRINGELSON. Make words your hobby. When you are writing and talking remember to talk loud and to keep your speech muscles in good working order by constant exercises.

Write pages and pages of your "Jonah" words. Write them out in full, speaking them as you write them.

Practice voluntary clonic spasms in the reading of simple material. All stutterers, whether their natural spasms are clonic in type or not, begin with this stage.

Against

DR. LEE EDWARD TRAVIS. Although phonetic drills are certainly not indicated in the treatment for stuttering, certain exercises in ordinary and interpretative reading, reciting poetry and singing may be helpful.

DR. SMILEY BLANTON. As to phonetic training, it is unwise and makes the stutterer most self-conscious of his speech. Practice in breathing may give the stutterer some relaxation, but if such exercises lead him to think that his stuttering is caused by defective breathing and take his attention from the psychologic factors, they will do more harm than good. Vocal exercises, such as are used to improve the voice of nonstutterers, and exercises, such as are used in any good class of voice training, may be used, but the stutterer should not be told that this is to cure him of stuttering.

DR. JOHN M. FLETCHER, New Orleans. As a student of this disorder, I have lodged criticisms against the diagnosis of stuttering as a mere physiologic incoordination induced by wrong habits of speech, and hence against the phonetic drill methods of treatment that are based on such a diagnosis.

THE USE OF SUGGESTION IN ATTEMPTING TO INDUCE BETTER SPEECH IN THE STUTTERER

For

MR. SAMUEL D. ROBBINS. The subconscious fear of stammering may be overcome by asking the pupil every night before falling asleep to picture the most confident person he knows speaking fluently to his old friends, and then to picture himself doing likewise.

DR. SMILEY BLANTON. The application of the best principles of child guidance should be put into practice in the home. Under mental hygiene is included the

methods of psychotherapy, suggestion, persuasion and mental analysis, psychoanalysis being a special type of mental analysis

DR CHARLES G STIVERS Replace the "I can't" by the "I can" In this, show the patient how pressing his palms together will make him conscious of the effort Tell him to remove one hand, which is the "I can't" idea, and the "I can" idea remains Explain that it is necessary to drop the sense that there is any blocking or damming of the ability to speak

Take any word over which the patient stammers Find out why he feels that he has to stumble Show him that the wrong feeling toward it is the reason why the word bothers him, not because any more effort is required to pronounce this word than any other

Against

DR ELMER L KENYON Early in the period of training, the effort at conscious control is applied to the act of talking Gradually this consciously controlled effort is developed until speech production has become normally smooth, excellent in quality and attended with little or no hesitation In order not to be misunderstood, I will state that "suggestion" has as little part in this training as it does in the teaching of proper management of the body in learning to swim

General Comment

DR G OSCAR RUSSELL, Columbus, O I hesitate considerably to discuss theories as to cause Everybody will have observed that most of the various schools of treatment may be credited with certain effective results A careful scrutiny of the therapy used by these groups espousing many and varied and often conflicting theories will show that the methods of treatment have much in common in most cases Furthermore, in no particular case that I know of is that therapy based entirely on the theory in question All of us owe each other and those who have gone before us a great deal

DR ELIZABETH A McDOWELL Perhaps the most outstanding obstacle to real progress in improving our technic for correcting stammering is our tendency to oversimplification of the problems involved We are seeking the alchemist's stone which will reduce all of our hunches to golden facts with one experimental effort Our literature is devoted largely to espousals of theories explaining this or that alleged cause of the phenomena and prophecies that the removal of this cause will bring permanent cures For this reason, our field has long been fertile ground for the "quack" or the cure-all specialists Many of our most skilful therapists will practice their arts of speech improvement with admirable results and discriminative effort, and then they will sit down in arm-chairs and weave explanations of the reasons for their success into a logical romance with some one attractive notion as the hero

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Regular Meeting, Jan 5, 1931

GEORGE DENNIS, M D, *President, in the Chair*

NORMAL INTERIOR LARYNGEAL FUNCTIONS WHICH BLOCK THE VIEW OF THE GLOTTAL LIPS (MOTION PICTURE DEMONSTRATION)

DR G OSCAR RUSSELL, director of Phonetics Laboratory, Ohio State University, Columbus, Ohio

The pitch used by the subject during articulation radically affects the view of the vocal lips Very low pitches cause so-called "retracted epiglottis" The pulvinar is pulled toward the cartilages of Wrisberg, causing postero-anterior closure Excessively high pitched tones or "tight" or stringent voices cause

constriction of the lateral interior part of the larynx hiding all but a mere edge of the vocal lips. Some vowels expose a view of the full length of the vocal lips, others shut off the view progressively more and more. The interior of the larynx closes (anteroposteriorly) more and more, thus impeding the view in a progressively increasing way as one passes through the vowel series i-peep, I-pip, e-pape, e-pep, ae-pap, a-pup, a-pop, o-paw, o-pope, u-poop.

The x-ray pictures published in my "Speech and Voice" show that the front cavity for "ee," (i) is hardly as big as one's finger, and it is therefore impossible to insert an ordinary laryngoscope through it for any kind of a view (as one can my "Nongag glottoskop" or my "Tonolaryngoskop") without enlarging that anterior buccal cavity more than the vowel will permit. If the cavity is enlarged, the vowel changes to the following. First, usually to the vowel "uh" (ə) as in "pup." It is true that part of the cords are then visible, but they look dumpy. The anterior half remains hidden. Second, to the vowel "ih" (a) as in "pop," producing a "retracted epiglottis." No cords are visible. Third, to something between (I) as in "pip" and (e) as in "pep" when more of the cords will be visible. In other words, roentgenograms of the vowel "ee" (i) "peep" show the largest distention of the pharynx and the smallest distention of the mouth. Hence, if proper apparatus is available that is the best vowel to use in order to avoid impediment of the view of the vocal cords.

A guttural voice closes the false cords and hides the vocal lips. Gargling causes both posterioranterior and lateral closure. A gagging or interrupted voicing closes the false cords above the vocal lips. A cough closes the ventricular bands above the vocal lips, thus hiding them. Clearing the throat closes the false cords as well as the vocal lips.

Hence, it is absolutely necessary that the subject articulate on his normal easy range speaking tones, with relaxed free quality, if an unimpeded view is to be had of the vocal cords throughout their whole length and of the entire interior of the larynx.

DISCUSSION

DR LEO KALLEN. That intralaryngeal activity, per se, other factors supposedly being equal, exercises an influence on, or rather that it actually is one of the conditions on which quality and character of voice depend, is a fact that has been known for several decades, beginning with the classic attempt of Czermak in 1860, to photograph laryngoscopic images, which were successful enough to depict the cords in phonation, the shape of the glottic chink and the relation of the ventricular bands.

With the development of photographic technique, depiction of the interior of the larynx in its varying phases of function made corresponding progress. However, it is really only in the last two decades that technical skill has made it possible to depict the larynx with an ever decreasing quantum of imperfection.

Dr Russell has given an excellent demonstration of a motion picture of intralaryngeal activity synchronized with its vocal effect. This is an important achievement, not only because of a faithful portrayal of a process otherwise hidden, except to the eye of a phonendoscopic observer, but because synchronization with sound offers a new method of study and instruction. Those of us who are concerned with the diagnosis and treatment of functional disturbances of voice are in need of more and more information concerning intralaryngeal processes in connection with vocalization. Dr Russell's success in synchronizing these two in the form of a tonal motion picture is an important step in that direction.

DR ELMER L. KENYON. Somewhat more than a century ago the present national movement for the education of the deaf in speech and lip reading was inaugurated. About twenty-five years ago a national movement for the educational treatment of disorders of speech and of hearing was likewise inaugurated. Last week the fourth national convention of the American Society for the Study of

Disorders of Speech, an organization that is attempting to guide this newly developing movement, was held in Chicago. This newer movement should have the sympathetic cooperation of the medical profession.

By its very nature, the ordinary laryngoscope cannot show the interlaryngeal movements without interference with free action of the vocal cord excepting in certain patients for the sounds "ah" (are) or "aw" (awed), and, in addition, it cannot show most of the sounds of the language at all. Killian was instrumental in bringing the larynx into direct view, but with practically complete suppression of movement. Dr. Russell, following with his mechanically acute mind the more basal work of his predecessors, has opened up for us in two ways an almost unhampered view of the interior of the larynx in action for any sound. These new electrically lighted laryngoscopes are of real value to the laryngologist, and will in time become a part of his armamentarium and of that of our medical schools. They can be used equally well by nonlaryngologists who are interested in disorders of speech. Dr. Russell receives no personal profit from the sale of these instruments.

Now we are enabled to witness further fundamental progress in the disclosure of the interior of the larynx in action. These interior movements are disclosed in detail and with clearness as motion pictures. About twenty years ago, working from the standpoint of the extrinsic movements of the larynx, I was able to point out that each basal sound of the language must require detailed differences in the approximation of the vocal cords. It is now of great interest to me to have the accuracy of my observations proved by these motion pictures of the interior of the larynx in action.

The interpretation of the significance of the movements, as disclosed, will require much time and study. Exactly what movements serve to produce a certain type of sound, as to language significance, musical quality and pitch, must be gradually determined. This information will be a companion to the evidence of the sound itself, which we have always had. But these facts, even together, cannot solve the problem of developing the artistic voice. That problem concerns the question of so controlling the musculature of speech production as to attain any desired vocal result. Just how these pictures are to forward the solution of that problem is yet to be determined.

The complexity of the movements within the larynx is remarkable. Did you ever think that the larynx gives the brain no knowledge of what is going on within it? There is no way in which the brain can directly understand what is going on in the larynx except in the vocal result. In order to realize the complexity of the act of voice production, we must think of the movements of the extrinsic muscles of the larynx, which also are complicated, as well as of the intrinsic muscles. The extrinsic and intrinsic muscles, are controlled in action for voice production by an automatic cerebral mechanism, which acts indirectly in accordance with the conscious purpose of the individual to produce a definite sound. The problem of voice development consists in the determination of exactly how to gain control of these muscles in order to produce any particular vocal result at will. The motion pictures throw new light on how the larynx produces particular vocal sounds, but they do not solve the problem of how to control the vocal mechanism in order to attain to particular sound results. What they may ultimately contribute to this practical purpose is a matter for the future to decide. That they may be developed into a diagnostic procedure of much importance in certain doubtful cases seems highly probable.

Dr. Russell tells me that he has already made 1,000 motion pictures of the interior of the normal larynx, largely in singers, and thus is being opened up a large new field of study.

DR. ROBERT SONNENSCHN. Dr. Russell has done marvelous work. It seems to me that we have in these pictures a proof of the fallacy of the former assumption that in the movements of the larynx during swallowing the epiglottis folded backward and closed the glottis. These pictures do not show the act of swallowing, but I take it that in some of the movements of speech the motion is

almost the same as in swallowing. For a time it was thought that the movements of the arytenoids helped to close the larynx during swallowing. Then again, a few years ago, Dr. Mosher presented an excellent paper in which he stated that from x-ray studies he assumed that the epiglottis covered the larynx in the act of swallowing. I think that in these pictures we see that it is the movement of the arytenoids and the false cords that serve this purpose.

DR. ALFRED LEWY. I do not see how these pictures can show one thing very well, namely, the up and down movements of the larynx which occur during phonation. I do not know how Dr. Russell can show that in addition to the anteroposterior and lateral movements, but perhaps he can devise something that will also show those movements.

Also, in the use of the laryngeal mirror we do not find that in most cases the attempt to phonate the vowel "e" gives us the best view of the interior of the larynx, but, of course, conditions are changed by our traction on the tongue. Sometimes the "hi" and sometimes the "e" is better. That is another demonstration of the fact that by using traction on the tongue as we have to we are disturbing the normal relation of the larynx.

I wish to take issue with Dr. Kenyon concerning one matter. I have always felt that the patient was always conscious to a certain extent of the movements of the larynx by something like kinetic sense, that we are not dependent entirely on audition. That has been told me repeatedly by singers, who have said their vocalization "did not feel right." This has impressed on me that there is some sensation akin to kinetic sense in addition to the auditory sense.

DR. ELMER L. KENYON. I agree with Dr. Lewy, however, there is no question but that the statement I made is essentially true. We get these movements in the larynx primarily by thinking of the sound. However, there is a distinct sensation related especially to the mold of the mouth required for the sound, and, as I believe, to the action chiefly, not of the vocal cords themselves or of their muscles, but to the extrinsic muscular movements. Undoubtedly such sensations are of great value to singers, and they also serve primarily to enable the deaf person to acquire speech.

DR. J. HOLINGER. Years ago I was in a position to amputate the epiglottis on account of tuberculosis, often down to the lowest ridge, and no loss of function could be noticed. The swallowing was often greatly relieved, and no food entered the larynx. I came to the conclusion that we overestimated the importance of the epiglottis. Patients with such conditions now go to tuberculosis institutions, as soon as we make the diagnosis, and we do not hear any more of them. A large amount of material must accumulate there. So far, in our Society, I have not heard of any scientific contribution on the subject that would be adequate.

DR. G. OSCAR RUSSELL. The pictures shown here form a part of a larger study financed by the Carnegie Foundation and conducted in collaboration with members of the American Academy of Teachers of Singing and of prominent opera and other vocal stars of this country and abroad. The purpose was to establish the physiologic causes of differences in the quality of the voice. The major part of these experiments consisted of x-ray pictures taken at a high rate of speed. A large number of subjects were utilized including Althouse, Borí, Gigli, Johnson, Tibbett and many others of recognized vocal ability. By our x-ray technic we have been able to devise a set-up that makes it possible to compute the exact length of the vocal cords, likewise, to indicate the rise and fall of the larynx, the opening and closing of the velum, and dimensions of the vocal cavities themselves and of the openings, including those of the lips. All of these may be measured accurately to a fractional part of a millimeter. It will be seen, therefore, that the best information bearing on the question asked would be obtainable from our x-ray studies rather than from the moving picture studies of the vocal cords presented tonight.

The only way we would have of ascertaining whether the larynx rises or falls by study of these motion pictures of the vocal cord (since they are from

a superior laryngeal position) would be by observing the field and also by studying the changes in focus. That would not be anywhere near as reliable as the x-ray pictures in question.

As to the point raised by one other question, I do not believe it is possible to find a subject who will be able to articulate a clear vowel "ee" during the old style laryngoscopic examination in which the ordinary laryngeal mirror is inserted and the light is reflected in by means of a condensing head mirror, or by some of the more recent laryngeal mirrors which attach a light at the distal end of the handle immediately in front of the laryngoscopic mirror. The reason is obvious when you recall the x-ray pictures included as a part of the demonstration tonight. For the vowel "ee" requires a very small buccal opening, normally no larger than your finger. And since this curves upward, it is not possible to see through it into the posterior part of the pharynx. When this question first arose, I verified that observation by attending a large number of examinations by different doctors where the attempt was made to get the subject to articulate a clear "ee." I believe I could say that though the subject often thought it was the vowel he was producing, something approximating "uh" was invariably produced in lieu of the "ee." I stress this fact to get your reaction as you go back and listen carefully for the sounds you hear, and I should like to know that reaction, particularly as you may obtain it from your office assistants, nurses and strangers who are not expecting any particular sound. I dwell at length on this question, because this demonstration of films makes it clear that a vowel "ee" pronounced with unmistakable quality is necessary if a complete view of the interior of the larynx is to be had.

I was much interested in Dr. Kenyon's note to the effect that he had assumed long ago from exterior palpation and other methods that the larynx changed position rapidly in passing from one vowel sound to another, because when I published in my book, "The Vowel," the first still pictures of the vocal cord in unhindered vowel positions, I was taken severely to task by a few who insisted that the vocal cords did not look so long as they appeared in my pictures. The reason is obviously because that in all pictures taken formerly the ordinary laryngoscopic mirrors were used, resulting, as I have just pointed out, in necessity for the subject to articulate a vowel "uh." As you noted, this vowel "uh" invariably blocks off a substantial part of the view of the vocal cord. It is not possible to see the anterior commissure and the area well up under the pulvinar. You will have observed that these motion pictures verify the earlier still photographs. In all cases in which a clear vowel "ee" is articulated, the full length cord is shown in its stretched out appearance. And the whole interior of the larynx as well as the pharynx is seen to change as one passes from vowel to vowel.

I agree with Dr. Kenyon that my "Nongag Glottoskop" is the most valuable of all the laryngeal pieces of apparatus I have devised. You will notice that the subject may close his lips and can articulate practically any speech sound. Its usage with an "m," therefore, makes it possible also to obtain a sharp, clear view of the whole nasopharynx viewed from beneath, so that in examinations for adenoids it likewise has distinct advantages.

THE PRACTICAL VALUE OF THE AUDIOMETER DR. G. HENRY MUNDT

The audiometer is a practical mechanism for making graphic records of hearing by which the future progress of the patient may be judged. It is the only mechanism by which a reasonably accurate percentage of loss of hearing may be determined. The audiogram is the only practical graph by which a patient may be watched by different otologists. A satisfactory audiogram can be made in many patients who seem unable to cooperate sufficiently for good fork tests. This is especially true in children. There are other methods superior to the audiometer for testing the lower tones, but the audiometer is the best mechanism for testing the upper portion of the scale. Defects in the upper portion of the tone scale call for a careful general examination of the patient. An audiometric study should be made in every patient who complains of defective hearing.

DISCUSSION

DR LOIS D GREEN In collaboration with Dr Shambaugh, I am attempting to clarify some of the factors of bone and air conduction as recorded by the *IA* audiometer and thus give added practical value to the examination.

The customary audiometer curve I shall designate as the standard curve, and it is taken with the head phones in contact with the head and cushioned with sponge rubber. This is the curve ordinarily designated as air conduction. In cases of otosclerosis or other conduction deafness, the picture given by this curve differs markedly from that given by the whispered voice and tuning forks by air conduction. In order to give a truer picture of the loss of hearing by air conduction in these cases, I began taking audiograms, holding the receiver as near to the auricle as possible but without any contact with the head. These I designated pure air conduction curves, and they were made on normal subjects, patients with conduction deafness and those with nerve deafness. They were plotted on the same charts with standard curve (phones in contact) and bone conduction curves made by the Western Electric bone conduction receiver No. D 80904.

In the course of a year certain points have become apparent. The curve for pure air conduction in normal subjects is from 20 to 30 sensation units lower than the standard curve for frequencies up to 1,024 double vibrations or more usually 2,048 double vibrations, when it becomes only about 5 units lower and parallels closely the rest of the standard curve.

In a true conductive lesion, the pure air conduction curve is from 40 to 60 units lower than the standard curve for the lower frequencies and again approaches to within from 5 to 10 units of it at 2,048 double vibrations. This gives a truer picture of the useful hearing of a patient with a conductive lesion. In a true nerve lesion the pure air conduction curve bears the same relation to the standard curve that it does in the normal ear.

When the bone conduction receiver is used the results are apparently not reliable beyond 512 to 1,024 double vibrations, unless the patient is very deaf. At these points the instrument is emitting so much sound by air that the curve is almost the same whether the apparatus is in contact with the head or slightly removed.

In cases of distinct conduction deafness, the curve produced by the bone conduction receiver may rise above the standard and pure air conduction curves and approach that of normal hearing. In cases of nerve deafness, it bears the same relation to the other curves that it does in the normal, being from 20 to 40 units below the standard curve at from 32 to 64 double vibrations and about 60 units below at from 512 to 1,024 double vibrations.

These observations suggest that the standard curve with the phones in contact with the head does not represent the true air conduction, but that a true air conduction curve will have to be developed and standardized. They are also of aid in visualizing and recording more accurately various type of deafness. Possibly additional light will be thrown on the Rinne and Schwabach tests, particularly if the work can be done in a sound proof room.

DR G OSCAR RUSSELL I think that Dr Green's contribution is vital, and I believe that much more work of this sort is needed. In one of the papers I presented before this Society last year, I showed a hearing test graph which could advantageously be used in lieu of an audiogram. It is used as is the latter with any Western Electric *2A* or *1A* audiometer, but has an advantage over the audiogram in that it shows at a glance the exact status of the subject's hearing in terms of the amount of hearing remaining and lost for each tone and the whole or any part of the range, so that the median or peak is also graphically portrayed without any computation or reference to a conversion table. These advantages over the audiogram need no comment. I believe that Dr Bunch and Dr Shambaugh, who had protested at some rather loose usage of the computation of loss of hearing on the audiometer, are justified. The former has made a particular point of the fact that the customary statement of loss of hearing is not adequate. One principal reason why this is true is that the term represents a too vague

generalization This is particularly so when one follows the recommended procedure of choosing three tones in the middle of the spectrum and averaging these with an arbitrary correction for a statement of what hearing is remaining in the subject We long since observed that pedagogically, at least, all kinds of false conclusions are thereupon drawn It is admissible that this statement is infinitely superior to what was formerly available, but surely we should not be content with anything less than the best Since it is inadequate, it would seem advisable to cease the usage of this statement of loss of hearing There may be times when a statement of the median loss through the whole audiometer range would suffice, and might stand as a statement of the individual's hearing status, but the question arises in that connection whether it would often not be better to use the peak loss as a criterion by which to judge Certainly it is true that for pedagogical purposes it is often absolutely necessary for us to know whether the loss is in the low frequencies or high frequencies, and the teacher must of necessity know whether the loss in the low frequencies is serious Over 40 per cent of the meaning of speech is carried in a rise and fall in intonation which involves the area from 60 to 256 cycles in male voices, and this is precisely the area that is left out of consideration in the usual statement of loss of hearing computed on the basis of the three tones previously mentioned On the other hand, if the teacher is engaged in correcting difficulties of speech, it is quite essential that she know the status of the person's hearing over the range from 3,000 to 8,000 cycles, for this is precisely the range involved in the characteristic tones required for the production of such sounds as "s," other fricatives and even most unvoiced stops

The physician cannot be blamed for not desiring to waste the time necessary in order to refer back to a conversation table and compute the loss of hearing for each individual tone This is the principal reason why we prefer the aforementioned hearing test graph in lieu of the audiogram It shows everything the audiogram does, and at the same time indicates at a glance just exactly what the loss of hearing is for any particular range It can be used for either the 1 A or 2 A audiometer The patient who takes such a graph with him is better directed, and this is particularly true of children whose teachers need to know what can and cannot be done in the matter of training and retraining the sound patterns involved in a cerebral loss of hearing, which must inevitably follow a functional loss if nothing is done I believe otologists generally could render a great service to the people of this country if they would all give their full support to recent moves they have fostered which tend in that direction I refer particularly to those sponsored by Dr Hayden and others behind the work of the League for the Hard of Hearing

I wish to call attention to the phonograph speech tests now available through the work of Dr McFarland, since through their use considerable information may be added to our present stock of knowledge in regard to the cerebral deafness

DR G W BOOT I remember some years ago hearing a highly scientific paper read before the Chicago Ophthalmological Society on the proper method of illuminating a test card The essayist proved by calculus and demonstrated by means of a graph that the only correct method of illumination was by means of a parabolic mirror

In this highly scientific age, if an article is not illustrated by one or more graphs it is discredited, and if the author of a paper furnishes the requisite number of graphs it is accepted as scientific I often wonder how Darwin managed to put his great work across without a graph to illustrate it

The audiometer has two of the modern requisites, one always has a graph to show and one uses that modern method devised by Henry Ford and introduced into medicine by the famous clinic that habitually introduces its papers by the statement "in our last 10,000 cases," or words of similar import—mass production

DR ROBERT SONNENSCHN I always hesitate to say anything about the audiometer because the impression has gone abroad that I am prejudiced against it, but this is absolutely not so I think the audiometer has certain advantages, and feel that Dr Mundt is to be congratulated for his fair way in presenting it

Most persons say we cannot practice otology without it, forgetting that innumerable persons were examined successfully before it was devised. In many ways it is practical from the standpoint of speed, ease of manipulation, etc., as compared with other methods in vogue.

First, let me call your attention to the fact that while the audiometer is an instrument of precision, and I have always been in favor of such devices and methods, the various types of audiometer are not calibrated alike. The Western Electric is best known and most widely used. It is calibrated so that it tells the loss of hearing in sensation units, and to get the percentage of loss of hearing you multiply the number obtained by 0.8. But the calibrations of the Jones-Knudsen, of the Krantz, the Dean-Bunch and the Gutman audiometers (the latter it seems was the first one to use the vacuum oscillator tube in connection with the audiometer) are entirely different. I do not know about the physics of the subject, but I am told that the curves or graphs of the different apparatuses are not comparable. It is true that it is nice to have graphs to show the differences in hearing at various times, but it is well not to forget that no less an authority than Harvey Fletcher stated that if we have the so-called "constant" of damping we get the same data regarding loss of sensation units with tuning forks that we do with the audiometer. The calculation is simple and he gives the formula. So if you have four, five or six calibrated forks you can get the same curve as with an audiometer. While I have always advocated that we should excite forks uniformly, it has been shown that the decrement or rate of damping of the fork is always the same even if there is some difference in the force used. The formula is loss of sensation units = $\Delta (t-t')$. Δ is the constant of damping, t = normal hearing time, t' = hearing time of patient. Let us say the decrement for the small a-1 is 1.5, the time the patient should hear it is 100 seconds, if you find the hearing is only 70 seconds you simply subtract this from the 100 and the difference is 30, multiplying this by 1.5 gives 45 sensation units loss. If you have the forks you can get the same graph that you do with the audiometer, but if you use many forks it takes a little longer. You can get the same graph you get with the Western Electric for it is calibrated by the same system, so there is no reason for saying that we cannot get the same graph with the forks as with the audiometer.

I must take exception to Dr. Mundt's statement that the Bezold forks are the only ones with which tests can properly be made, for I am sure you are aware of the work of our committee of the American Academy of Ophthalmology and Otolaryngology, and know that the forks prepared by Mr. Eisenbaur of the Riverbank Laboratory at a much lower price give the same data. I do not say this to deprecate the Bezold forks, but one can get the same results with the new magnesium alloy forks, which are rust and tarnish proof and weigh only one-third as much as steel.

Dr. Mundt quoted from Dr. Shambaugh's excellent paper which was read in Copenhagen. He stated that for the lower tones the audiometer is of no particular value, for the middle tone it is perhaps superior to the forks, and for the highest tones he thinks it is better than the forks. Recently Mr. Eisenbaur, of the Riverbank Laboratory, devised sounding rods of a pitch of c^5 (4,096 double vibrations) which vibrate from fifty to seventy-five seconds, whereas the best tuning fork of that pitch rarely vibrates longer than thirty seconds. He also perfected a rod of the pitch of c^6 (8,192 double vibrations). It is quite true that the earliest evidence of a change in the nerve of hearing is in the appreciation of the high tones, but the exact amount of hearing does not make any essential difference, all you need is an approximate idea. If the loss of hearing is marked, one can tell it in the course of ordinary conversation. By using the residual air in testing with unaccentuated whisper or conversation, one gets a practical estimate of the patient's hearing. Dr. Shambaugh also has pointed out the fact that you do not need any apparatus for this purpose. The audiometer is a good apparatus, it is fine for the study of the physiology of hearing and for research, as Dr. Shambaugh has shown, but I still contend that with a few good

forks, and tests properly made, one can get a good practical idea of the degree of hearing ability Dr Green demonstrated her work to me this afternoon, and while telephone men tell us that we get only air conduction with the receiver against the ear that is not entirely true, for we get some bone as well as air conduction We know that if we hold the receiver against the ear we hear better than when it is out of contact with the auricle

DR G HENRY MUNDT I think this type of discussion should continue, it is very wholesome I do not stand before this organization as an advocate of the use of the audiometer

Taking up Dr Green's discussion, the standard graph undoubtedly is valuable That will be worked out, and I have no doubt many of us will have audiometers which are far superior to this 2 A audiometer Such work as Dr Green is doing in an effort to get pure air conduction is valuable From a purely practical standpoint with one patient, I believe that the graph made today and made again in a few weeks is valuable Sound proof rooms are not easy to produce in Chicago I have tried it, and think Dr Green will have difficulty, unless she gets some distance from the ordinary units of transportation There is no question that hearing tests of any kind should be made in as nearly a sound proof room as possible I am perfectly willing to admit that when one figures the loss of hearing on an audiogram one has not a definite method Loss of hearing is, I think, better measured in the average individual by the voice test, but in the evaluation of progress in a patient the audiometer is superior

I appreciate Dr Sonnenschein's discussion, and if he reads my paper he will find that I said that as a minimum type of fork we should have the Bezold I was trying to eliminate the use of two or three small forks which are of little value to be more specific, the set commonly sold as Hartmann's tuning forks I said in this paper, and I have always maintained, that in determining the loss of hearing the voice test is probably more valuable than the audiometer, and yet for comparison from time to time the audiometer is the more valuable

Book Reviews

ATLAS DE ANATOMIA DEL ORGANNO DEL OIDO BY DR PEDRO BELLO Buenos Aires Estudio Grafico "Oceanic," 1930

Dr. Belou has presented in the form of an atlas a comprehensive and detailed study of the anatomy of the organ of hearing, in which every phase of its intricate anatomy has been included in anatomic preparations reproduced by illustrations. The material consists of 236 loose-leaf cards containing illustrations, many of which are prepared to be studied with the stereoscope. The volume represents a tremendous amount of work and will constitute a valuable addition to the library of those who are interested in something more than just the surgical side of otology. The work does not include in any detail a study of the histology of the internal ear.

Directory of Otolaryngologic Societies *

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman Dr Gabriel F Tucker, Bronchoscopic Clinic, University Hospital,
Philadelphia
Secretary Dr John J Shea, 1018 Madison Ave, Memphis, Tenn
Place New Orleans Time 1932

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President Dr J F Barnhill, Miami Beach, Fla
President-Elect S Hanford McKee, 1528 Crescent St, Montreal, Canada
Executive Secretary Dr William P Wherry, Medical Arts Bldg, Omaha
Place French Lick, Ind Time Sept 14-19, 1931

AMERICAN BRONCHOSCOPIC SOCIETY

President Dr Henry B Orton, 24 Commerce St, Newark, N J
Secretary-Treasurer Dr Louis H Clerf, 128 S 10th St, Philadelphia

AMERICAN LARYNGOLOGICAL ASSOCIATION

President Dr Francis R Packard, 304 S 19th St, Philadelphia
Secretary Dr George M Coates, 1721 Pine St, Philadelphia
Place Atlantic City, N J Time June 15-17, 1931

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY

President Dr Max A Goldstem, 3858 Westminster Pl, St Louis
Secretary Dr R L Loughran, 33 E 63d St, New York

AMERICAN OTOLOGICAL SOCIETY

President Dr David H Walker, 101 Bay State Rd, Boston
Secretary Dr Thomas J Harris, 104 E 40th St, New York

SECTIONAL

EASTERN NEW YORK EYE, EAR, NOSE AND THROAT ASSOCIATION

President Dr G G Marshall, 122 West St, Rutland, Vt
Secretary-Treasurer Dr Arthur F Holding, 142 Washington Ave, Albany
Time Third Wednesday of October, November, March, April, May and June

NEW ENGLAND OTOLOGICAL AND LARYNGOLOGICAL SOCIETY

President Dr Harry P Cahill, 520 Commonwealth Ave, Boston
Secretary-Treasurer Dr Lyman G Richards, 319 Longwood Ave, Boston

PACIFIC COAST OTO-OPHTHALMOLOGICAL SOCIETY

President Dr Chester H Bowers, 1136 W 6th St, Los Angeles
Secretary-Treasurer Dr Walter F Hoffman, 817 Summit Ave, Seattle

PUGET SOUND ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President Dr Albert E Hillis, 1115 Pacific Ave, Tacoma, Wash
Secretary-Treasurer Dr Francis A Brugman, 806 Cobb Bldg, Seattle
Time 8 p m, third Tuesday of each month, except July and August

* Secretaries of societies are requested to furnish the information necessary to make this list complete and to keep it up to date

SIOUX VALLEY EYE AND EAR ACADEMY

President Dr Claude T Uren, City National Bank Bldg, Omaha
 Secretary-Treasurer Dr Frederick H Roost, 420 Trimble Bldg, Sioux City,
 Iowa
 Place Fontanelle Hotel, Omaha Time November, 1931

SOUTHERN MEDICAL ASSOCIATION, SECTION ON EYE, EAR,
NOSE AND THROAT

Chairman Dr Fletcher D Woodward, Box 162, University, Va
 Secretary Dr W D Gill, 323 Medical Arts Bldg, San Antonio, Texas
 Place New Orleans Time November, 1931

SOUTHWESTERN MICHIGAN TRIOLOGICAL SOCIETY

President Dr Wilfrid Haughev, 65 W Michigan Ave, Battle Creek
 Secretary Dr R H Fraser, Battle Creek Sanitarium, Battle Creek
 Time Third Thursday of alternate months

STATE

COLORADO OTO-LARYNGOLOGICAL SOCIETY

President Dr C E Cooper, 227, 16th St, Denver
 Secretary Dr Rex L Murphy, Metropolitan Bldg, Denver
 Place Assembly Room of Metropolitan Bldg Time First Saturday of each
 month from October to May

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON EYE, EAR,
NOSE AND THROAT

President Dr Dorland Smith, 836 Myrtle Ave, Bridgeport
 Secretary-Treasurer Dr Walter L Hogan, 750 Main St, Hartford

EYE, EAR, NOSE AND THROAT CLUB OF GEORGIA

President Dr William L McDougall, 50 Whitehall St, S W, Atlanta
 Secretary-Treasurer Dr William O Martin, Jr, 412 Medical Arts Bldg, Atlanta

INDIANA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President Dr John W Carmack, 23 E Ohio St, Indianapolis
 Secretary Dr J Kent Leasure, 23 E Ohio St, Indianapolis

IOWA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President Dr Gordon F Harkness, 215 Main St, Davenport
 Secretary-Treasurer Dr W F Boiler, 105 East Iowa Ave, Iowa City

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY

President Dr John C Brown, 350 St Peter St, St Paul
 Secretary-Treasurer Dr Hendrie W Grant, Lowry Bldg, St Paul

MONTANA ACADEMY OF OTO-OPHTHALMOLOGY

President Dr L H Huber, Livingston
 Secretary Dr A W Morse, Phoenix Bldg, Butte
 Time Semi-annually

NORTH DAKOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr H B Beeson, 232 W De Mers Ave, Grand Forks
 Secretary-Treasurer Dr F L Wicks, Valley City

OREGON ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr H M Hendershott, 193 11th St Portland
 Secretary Dr Andrew J Browning, 418 Mayer Bldg, Portland
 Place Good Samaritan Hospital Time Third Tuesday of each month

RHODE ISLAND OPHTHALMOLOGICAL AND OTOLOGICAL SOCIETY

President Dr Raymond F Hacking, 105 Waterman St, Providence
 Secretary Dr Herman A Winkler, 224 Thayer St, Providence
 Place Rhode Island Medical Library Time 8 30 p m, second Thursday in
 October, December, February and April

UTAH OPHTHALMOLOGICAL SOCIETY

President Dr F M McHugh, 17 Exchange Pl, Salt Lake City
 Secretary-Treasurer Dr W Leroy Smith, Erza Thompson Bldg, Salt Lake City

VIRGINIA SOCIETY OF OTOLARYNGOLOGY AND OPHTHALMOLOGY

President Dr Fletcher D Woodward, Box 162, University
 Secretary-Treasurer Dr Henry Grant Preston, Harrisonburg

WEST VIRGINIA STATE MEDICAL ASSOCIATION, EYE, EAR, NOSE
 AND THROAT SECTION

President Dr S S Hall, Fairmont
 Secretary Dr G A Smith, Montgomery

LOCAL

ACADEMY OF MEDICINE OF NORTHERN NEW JERSEY, SECTION ON
 EYE, EAR, NOSE AND THROAT

Chairman Dr J Wallace Hurff, 86 Washington St, Newark
 Secretary Dr Earl LeRoy Wood, 31 Lincoln Park, Newark
 Place 91 Lincoln Park South Time 8 45 p m, second Monday of each month

ATLANTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr John R Childs, 45 Edgewood Ave, Atlanta
 Secretary Dr William O Martin, Jr, 384 Peachtree St, Atlanta
 Place Academy of Medicine, 38 Prescott St, N E Time 8 p m, last Thursday
 of each month

BALTIMORE CITY MEDICAL SOCIETY, SECTION ON OTOTOLOGY
 AND LARYNGOLOGY

Chairman Dr William R McKenzie, 11 E Chase St, Baltimore
 Secretary Dr James J Chisolm, Medical Arts Bldg, Baltimore
 Place 1211 Cathedral St Time 8 30 p m, last Friday of each month

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

President Dr George J Dennis, 25 E Washington St, Chicago
 Secretary-Treasurer Dr Austin A Hayden, 25 E Washington St, Chicago
 Place Medical and Dental Arts Bldg, 185 N Wabash Ave Time 6 p m,
 first Monday of each month from October to May

CINCINNATI OTO-LARYNGOLOGICAL SOCIETY

President Dr Edward D King, 707 Race St, Cincinnati
 President-Elect Dr M F McCarthy, Union Central Bldg, Cincinnati
 Secretary-Treasurer Dr Samuel Seltz, Provident Bank Bldg, Cincinnati
 Place University Club Time 6 45 p m, second Tuesday of each month from
 October to May

CLEVELAND ACADEMY OF MEDICINE, SECTION OF OPHTHALMOLOGY
 AND OTOLARYNGOLOGY

Chairman Dr William V Mullin, 9204 Euclid Ave, Cleveland
 Secretary Dr H C Rosenberger, 2064 E 9th St, Cleveland
 Place Winton Hotel Time Fourth Friday of each month

COLLEGE OF PHYSICIANS OF PHILADELPHIA, SECTION ON OTOLARYNGOLOGY

Chairman Dr Ralph Butler, 2007 Chestnut St, Philadelphia

Clerk Dr Karl M Houser, 1826 Pine St, Philadelphia

Place College of Physicians Time 8 30 p m, third Wednesday of each month from October to June

COLUMBUS OPHTHALMOLOGICAL AND OTOLARYNGOLOGICAL SOCIETY

Chairman Dr A M Hauer, 327 E State St, Columbus, Ohio

Secretary-Treasurer Dr Albert D Frost, 681 E Broad St, Columbus, Ohio

Time First Monday of each month

DALLAS ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President Dr L M Sellers, 717 Pacific Ave, Dallas, Texas

Secretary Dr W Mood Knowles, 717 Pacific Ave, Dallas, Texas

Place Dallas Athletic Club Time 6 30 p m, first Tuesday of each month from October to June The November, January and March meetings are devoted to clinical work

DETROIT OTO-LARYNGOLOGICAL SOCIETY

President Dr Don A Cohoe, 13535 Woodward Ave, Detroit

Secretary-Treasurer Dr R Lee Laird, 513 David Whitney Bldg, Detroit

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Secretary-Treasurer Dr R H Needham, 1304 Medical Arts Bldg, Fort Worth Texas

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Secretary Dr J M Robinson, Eye, Ear, Nose and Throat Hospital, Houston, Texas

Place Medical Arts Bldg, Harris County Medical Society Rooms Time 8 p m, first Thursday of each month from September to June

INDIANAPOLIS OPHTHALMOLOGICAL AND OTO-LARYNGOLOGICAL SOCIETY

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Secretary Dr Kenneth L Craft, Hume-Mansur Bldg, Indianapolis

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Secretary Dr O S Gilliland, Professional Bldg, Kansas City, Mo

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Secretary-Treasurer Dr J Frank Friesen, 727 W 7th St, Los Angeles

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